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Financial System Review

June 2011

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Preface

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

As part of its commitment to promoting the economic and financial welfare of Canada, the Bank of Canada actively fosters a stable and efficient financial system. The Bank promotes this objective by providing central banking services, including various liquidity and lender-of-last-resort facilities; overseeing key domestic clearing and settlement systems; conducting and publishing analyses and research; and collaborating with various domestic and international policy-making bodies to develop policy. The Bank's contribution complements the efforts of other federal and provincial agencies, each of which brings unique expertise to this challenging area in the context of its own mandate.

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

The Risk Assessment section is a product of the Governing Council of the Bank of Canada: Mark Carney, Tiff Macklem, John Murray, Timothy Lane, Jean Boivin and Agathe Côté.

The material in this document is based on information available to 17 June 2011 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.

Overview

This section of the *Financial System Review* (FSR) summarizes the judgment of the Bank of Canada's Governing Council on the main risks bearing on the stability of the Canadian financial system and on the policy actions required to mitigate them.

The international macrofinancial environment is still clouded by several potential threats to financial stability

The process of financial sector repair is continuing, and the economic recovery is proceeding at a steady pace in most advanced economies. As expected, however, it is taking considerable time and effort to resolve the underlying economic and financial imbalances. The international macrofinancial environment is still clouded by several potential threats to financial stability. Sovereign balance sheets remain strained in many advanced economies, and a small number of banks, particularly in Europe, are still undercapitalized and burdened with underperforming assets.

The path to a more resilient global financial system is further complicated by the two-speed recovery in global economic activity: while growth in advanced economies remains relatively modest, there are increasing signs of overheating in major emerging-market economies. Rapid growth in these latter economies is contributing to high commodity prices and broader global inflationary pressures. This two-speed recovery reflects, in part, the lack of exchange rate flexibility in many developing countries—a situation that is also delaying the resolution of global external imbalances.

Despite the challenging international environment, the Canadian financial system remains healthy

Despite this challenging international environment, the Canadian financial system remains healthy. For example, asset quality at Canada's major banks has improved further in recent months. Moreover, the aggregate financial position of the domestic non-financial corporate sector is solid, with corporate leverage remaining at low levels. The main source of concern domestically continues to be the high levels of debt carried by Canadian households in relation to their disposable income.

Risks to the stability of the Canadian financial system remain elevated and have edged higher since December

The Governing Council judges that, although the Canadian financial system is currently on a sound footing, risks to its stability remain elevated and have edged higher since December. The principal sources of risk (**Figure 1** and **Table 1**) are considered to be the same as those noted in the last FSR and emanate

primarily from the external macrofinancial environment. The key risks are:

Fiscal strains in peripheral Europe could trigger a generalized retrenchment from risk-taking in global markets

Global sovereign debt: In the near term, the principal risk for Canadian financial stability is associated with the acute fiscal strains in peripheral Europe. Whether or not a credit event occurs, these strains could trigger a sharp repricing of credit risk for other governments with high debt burdens, as well as a generalized retrenchment from risk-taking in global markets. If this happened, it would cause losses at financial institutions and increase the funding costs of banks around the world, including those in Canada. Over the longer term, unsustainable sovereign debt dynamics in several major economies outside the euro-area periphery—particularly in the United States and Japan—will also represent an important vulnerability in the absence of credible fiscal consolidation. The risk associated with global sovereign debt thus remains high and has edged even higher since December.

Resolving global imbalances will be a lengthy process

Global imbalances: There continues to be a risk that the large current account imbalances will be resolved in a disorderly manner, involving sharp adjustments to exchange rates and other financial asset prices. An orderly resolution of these imbalances requires a timely and sustained rotation of global demand. In other words, increased household savings and fiscal consolidation are needed in deficit countries, while greater domestic spending and more exchange rate flexibility are required in surplus economies. Implementing the structural changes needed to resolve global imbalances will be a lengthy process, and the risk of a disorderly adjustment remains high.

The macroeconomic environment could delay further progress in solidifying the global banking sector

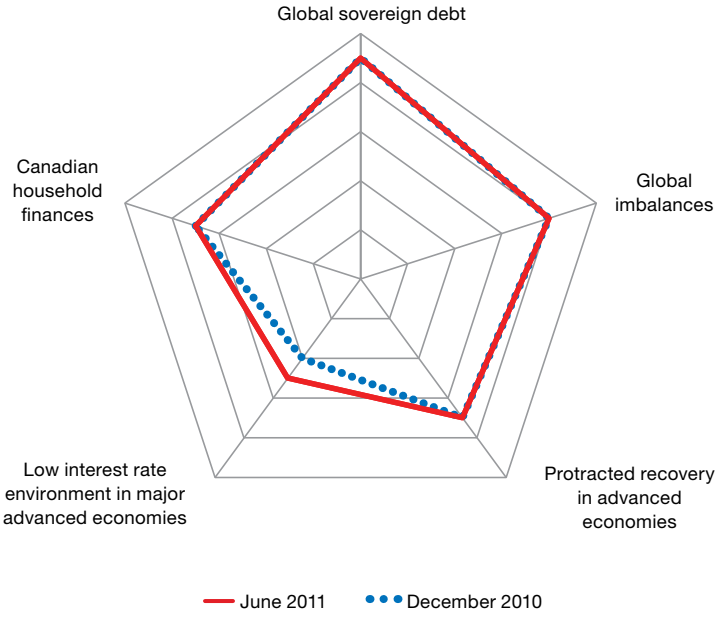
Protracted recovery in advanced economies: Internationally, banks have made substantial progress in repairing their balance sheets. However, some institutions continue to struggle as their efforts are impeded by the protracted economic recovery, high unemployment and the continued weakness of real estate markets. The risk that the macroeconomic environment could delay further progress in solidifying the global banking sector is still elevated and is broadly unchanged since December.

Low interest rate environment in major advanced economies: While stimulative monetary policy is needed to support the global economic recovery and to achieve price stability objectives, a long period of low interest rates may fuel excessive risk-taking. The search for yield could cause risk to be underpriced or lead investors to take on exposures that they may not be able to manage if macrofinancial conditions become less benign. In addition, the low cost of rolling over and extending weak loans could provide incentives for banks to delay writing down underperforming assets. The risk to the stability of the Canadian financial system arising from the low global interest rate environment remains moderate. It has, however, increased since December, given the growing popularity of riskier securities and strategies in both Canadian and global markets.

The popularity of riskier securities and strategies is growing

Canadian household finances: High levels of household indebtedness raise the risk that the impact of an adverse macroeconomic shock on the financial system could be exacerbated by a deterioration in the ability of households to service their

Figure 1: Risk assessment



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

Table 1: Key risks to the stability of the Canadian financial system

Risk	Level of risk	Direction of risk over the past six months
1. Global sovereign debt	high	edged higher
2. Global imbalances	high	unchanged
3. Protracted recovery in advanced economies	elevated	unchanged
4. Low interest rate environment in major advanced economies	moderate	increased
5. Canadian household finances	elevated	unchanged
Overall risk	**elevated**	**edged higher**

debts. Further moderation in the pace of debt accumulation by households is needed to contain the buildup in this vulnerability. On balance, the risk to financial stability arising from household finances remains elevated and broadly unchanged since December.

Further moderation in the pace of debt accumulation by households is needed

The key risks to financial stability are interconnected and mutually reinforcing. For example, fiscal strains and weaknesses in the euro-area banking sector are strongly intertwined. The cost of supporting the banking sector has eroded public finances in those countries, and the prospect of additional expenditures to support weak banks is adding to the tensions that some governments are experiencing in sovereign debt markets, particularly in Ireland and Spain. Meanwhile, the negative impact of fiscal consolidation on economic growth is weakening the credit quality of bank assets in those countries. In addition, the low interest

The key risks to financial stability are interconnected and mutually reinforcing

rate environment in advanced economies has boosted household borrowing in a number of countries that have weathered the crisis well, including Canada. It has also prompted increased capital flows to emerging-market economies. Excess demand in emerging-market economies and unsustainable sovereign debt in advanced economies are, in turn, important manifestations of global imbalances.

While the forceful global policy response since the onset of the crisis has begun to bear fruit, addressing the risks to the stability of the international financial system requires additional policy actions across a wide front. If the significant fragilities that still burden the financial system are not addressed in a timely manner, the progress achieved to date could be derailed.

The most pressing issue internationally is to take additional steps to consolidate public finances and to shore up the balance sheets of banks that are undercapitalized and burdened with underperforming assets. Banks that are not viable need to be resolved. In Canada, the elevated levels of household debt require continued vigilance. The Government of Canada further adjusted the rules for government-backed insured mortgages in January. While these measures will help moderate the pace of debt accumulation by households, it will take some time for their full effect to be felt. Canadian authorities will continue to co-operate closely in monitoring the financial situation of the household sector.

Canadian authorities will continue to co-operate closely in monitoring the financial situation of the household sector

Meanwhile, it is essential to keep up the momentum of structural reform to improve the resilience of the global financial sector over the medium term. A key element is the implementation of the new international standards for bank capital and liquidity. The Office of the Superintendent of Financial Institutions (OSFI) is encouraging Canadian banks to pursue full implementation of the Basel III capital standards early in the transition period, which starts in 2013. But enhanced prudential standards are not sufficient to preserve financial stability in the future. Credible frameworks for resolution are essential to ensure that all banks, even those that are large and complex, can be resolved in a timely and orderly manner. In addition, global financial markets need to operate on a sounder foundation, with stronger infrastructure, such as central counterparty services. The Bank is working actively with the industry and other policy-makers to develop central counterparty services for Canadian over-the-counter and fixed-income markets. Safeguarding financial stability also requires firm implementation of the G-20 commitments to co-operate in promoting an orderly, timely and sustained resolution of global imbalances.

OSFI is encouraging Canadian banks to pursue full implementation of the Basel III capital standards early in the transition period

Risk Assessment

This section of the *Financial System Review* outlines the Governing Council's evaluation of the key risks to the Canadian financial system. After a brief survey of macrofinancial conditions, the main potential threats to the domestic financial system are examined. The objective of the *Review* is not to predict the most likely outcomes for the financial system but to raise early awareness of key risks and promote mitigating actions.

Macrofinancial conditions

The economic recovery is proceeding at a steady pace in the major advanced economies. In contrast, accommodative monetary policies, strong capital inflows and robust credit growth are reinforcing buoyant demand in emerging-market economies. Together with persistent excess demand in these economies, high commodity prices (**Chart 1**) are contributing to broader global inflationary pressures.

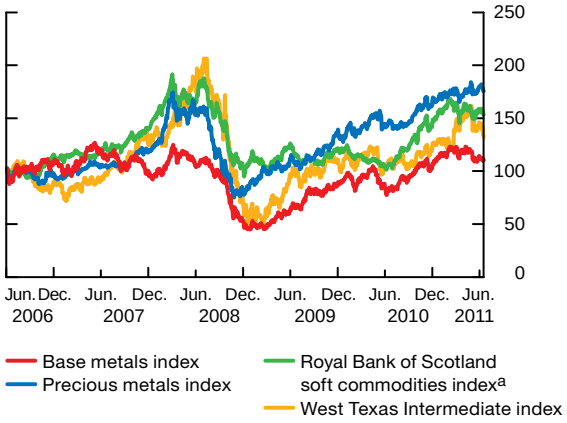
Global financial conditions remain stimulative and investors have become noticeably less risk-averse

Financial markets have generally continued to function well since December. However, there is still some pressure in global short-term bank funding markets, particularly with regard to the demand by euro-area banks for funding in U.S. dollars (**Chart 2**).[1]

Despite the significant challenges to the global economic outlook, investors are showing a clear willingness to bear risk. Continued strong investor demand for investment-grade corporate bonds has contributed to a modest tightening in credit spreads (**Chart 3**), even though issuance of new securities remains elevated. After solid gains early in the year, global equity prices have broadly retreated since April. Returns have varied across jurisdictions, consistent with the uneven pattern of the global recovery and persistent weaknesses in some regions (**Chart 4**). The acute strains in funding markets for highly indebted governments and weakened banks also suggest that risk-taking is not indiscriminate.

Chart 1: Commodity prices remain elevated

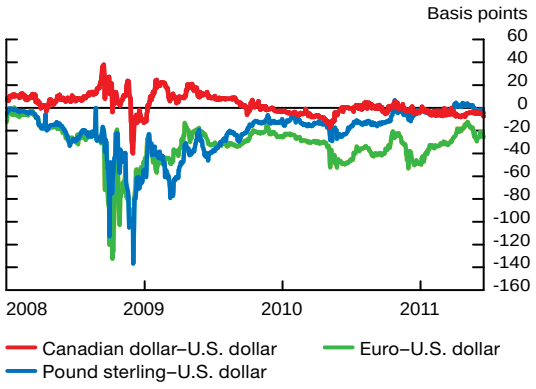
Indexes (1 June 2006 = 100)



a. The RBS soft commodities index is based on 13 agricultural commodities.
Sources: Bloomberg and Royal Bank of Scotland
Last observation: 17 June 2011

Chart 2: Market pressures remain for U.S.-dollar funding for euro-area banks

1-year cross-currency basis swaps

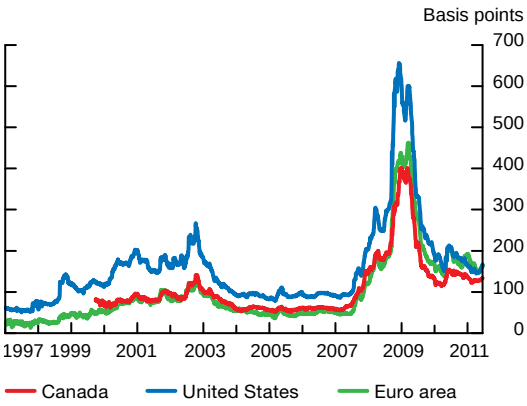


Source: Bloomberg
Last observation: 17 June 2011

1 For example, the euro–U.S.-dollar cross-currency basis swap is negative, which indicates a shortage of U.S.-dollar funding for euro-area banks.

Chart 3: Spreads on investment-grade corporate bonds have narrowed modestly

Options-adjusted spreads between investment-grade corporate debt indexes and government bonds

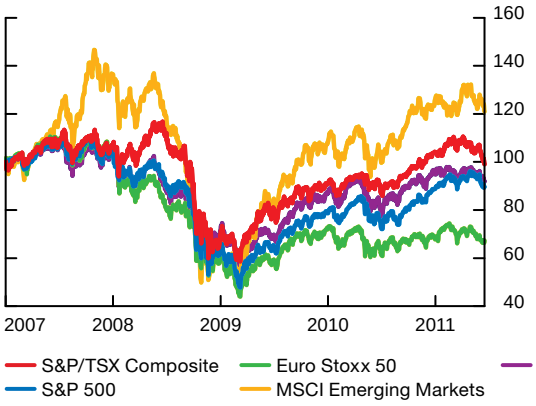


Sources: Bloomberg and Bank of America Merrill Lynch

Last observation: 17 June 2011

Chart 4: Recent developments in equity markets have mirrored the uneven pace of the economic recovery

Equity indexes (1 September 2007 = 100)

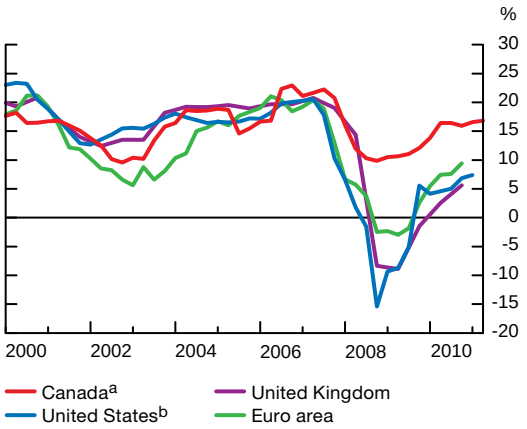


Source: Bloomberg

Last observation: 17 June 2011

Chart 5: Canadian banks continue to post higher returns on equity than their international peers

Average return on equity of major financial institutions



a. Data for Canadian banks are based on their fiscal year (FY 2011Q2 ended in April).

b. U.S. data exclude Goldman Sachs, Merrill Lynch and Morgan Stanley.

Source: Bloomberg

Last observations: Canada 2011Q2
United States: 2011Q1
Other countries: 2010Q4

While the legacy of the crisis continues to weigh on the international banking sector, the Canadian banking system remains solid

The average net income of Canadian banks declined in the fiscal quarter ending in April as a result of slower growth in, and lower net interest margins on, personal loans, as well as reduced trading revenues. Canada's banks nonetheless continue to post substantially higher returns on equity than their international peers (**Chart 5**), whose profit growth was driven by a decline in loan losses.

The capital positions and credit quality of the loan portfolios of Canadian banks have also improved further with the continuing recovery. While loan writedowns and delinquent mortgages in the United States have fallen from their recent peak in the second half of 2010, they remain well above those in Canada (**Chart 6**).

KEY RISKS

This section explores each of the risks that the Governing Council judges to be the main potential threats to the stability of the Canadian financial system.

Global Sovereign Debt

The unsustainable debt burdens of governments in several advanced economies continue to represent the principal threat to the stability of the Canadian financial system. The chief risk in the near term is associated with the current situation in peripheral Europe. Despite continued efforts by the countries affected and assistance from the International Monetary Fund (IMF) and other members of the European Union (EU), fiscal strains in the euro area have continued to build since December. Markets have been pricing in a significant probability of default for Greece and, to a lesser extent, for Ireland and Portugal. Whether or not a credit event occurs, a further deterioration of the situation could trigger a sharp repricing of credit risk for other heavily indebted countries or a retrenchment from risk-taking, both within and outside the euro area. This could severely restrict access to funding, undermining the global economic recovery. While the direct exposure of Canada's financial sector to highly indebted countries in the euro area is low, the sector is nonetheless vulnerable to second-round effects.

Over the medium term, sovereign debt is a much broader concern. The debt dynamics in a number of advanced economies—notably the United States and Japan—are unsustainable. Without timely measures to restore fiscal sustainability, these dynamics could also become an important source of vulnerability to the global financial system.

Unsustainable sovereign debt burdens in advanced economies continue to represent a high degree of risk for the Canadian financial system, and this risk has edged higher since December.

Table 2: General government net financial liabilities and budget balances as a percentage of nominal GDP[a]

	2007		2010		2015 (IMF projection)	
	Net financial liabilities	Budget balance[b]	Net financial liabilities	Budget balance[b]	Net financial liabilities	Budget balance[b]
G-7 countries						
Canada	22.9	1.6	32.2	-5.5	34.4	-0.2
France	59.3	-2.7	76.0	-7.0	80.1	-2.2
Germany	50.1	0.3	53.8	-3.3	52.6	-0.1
Italy	87.3	-1.5	99.6	-4.5	99.5	-3.1
Japan	81.5	-2.4	117.5	-9.5	156.8	-7.4
United Kingdom	38.2	-2.7	69.4	-10.4	76.5	-2.3
United States	42.6	-2.7	64.8	-10.6	83.4	-5.5
Euro-area periphery						
Greece	80.4[c]	-6.7	114.2[c]	-9.6	N/A	-2.1
Ireland	12.2	0.1	69.4	-32.2	106.4	-4.3
Portugal	58.1	-2.8	79.1	-7.3	99.5	-5.8
Spain	26.5	1.9	48.8	-9.2	62.7	-4.6
Advanced economies (average)	45.4	-1.1	64.8	-7.7	78.0	-3.4
Emerging economies (average)	25.0	0.1	26.9	-3.8	22.7	-1.4

a. Data refer to the general government sector and consolidate accounts for the central, state and local governments in addition to social security. Net financial liabilities are defined as "all financial liabilities minus all financial assets of general government."
b. Surplus (+) or deficit (-)
c. Net financial liabilities for Greece are from the OECD *Economic Outlook*, May 2011

Source: IMF *Fiscal Monitor*, April 2011

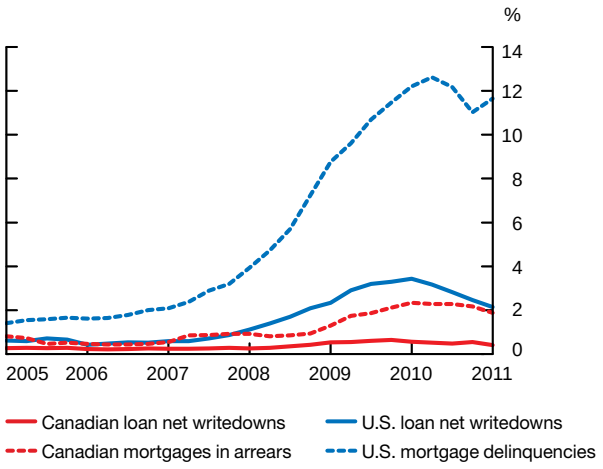
Returning sovereign debt burdens to sustainable levels is a substantial challenge in many advanced economies

Fiscal positions, which were already under pressure from secular factors such as demographic trends, deteriorated further during the recession as a result of reduced tax revenues and increased government spending to support the economic recovery. According to data compiled by the IMF,[2] the average net financial liabilities of governments in advanced economies rose from 45 per cent of GDP in 2007 to almost 65 per cent in 2010 (**Table 2**). In most advanced economies, government (or public sector) debt ratios are still rising, and financing requirements are at or near historical peaks. Although IMF projections for net financial liabilities and fiscal balance for 2015 are, on average, lower than they were a year ago for these economies, significant further adjustments are necessary to return debt burdens to sustainable levels (**Chart 7**). Of note, these forecasts assume that nominal interest rates will be roughly in line with nominal growth rates. Should a country's borrowing rate rise as a consequence of investor concerns about its creditworthiness, the required adjustment would be even larger.

The combined fiscal positions of Canada's federal, provincial/territorial and municipal governments deteriorated during the crisis, but not by as much as in many other countries. While federal and provincial governments have, in aggregate, run deficits since the onset of the crisis, Canadian governments are collectively on a path to restore fiscal balance by 2015.

Chart 6: Credit risk remains significantly lower in Canada than in the United States

As a percentage of total loans



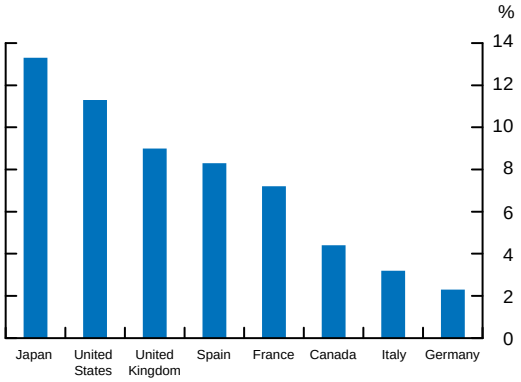
Sources: U.S. Federal Reserve and regulatory filings by Canadian banks

Last observation: 2011Q1

2 The April 2011 issue of the IMF *Fiscal Monitor* provides detailed analysis on the level of worldwide sovereign debt burdens and the magnitude of the required fiscal adjustment. This report is available at <http://www.imf.org/external/pubs/ft/fm/2011/01/pdf/fm1101.pdf>.

Chart 7: Significant further adjustments are needed to return sovereign debt burdens to sustainable levels

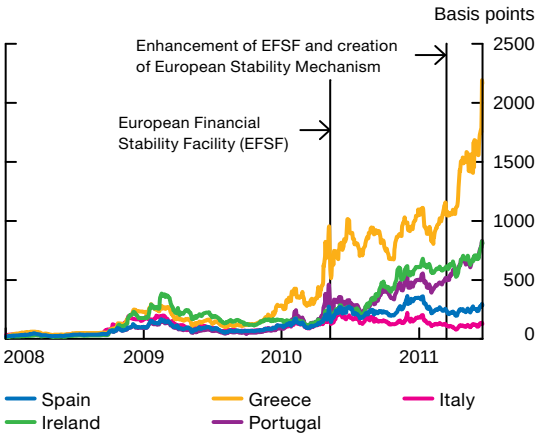
Projected fiscal adjustment over 2010–15 as a percentage of GDP[a]



a. Cyclically adjusted primary balance adjustment needed to bring the gross debt ratio to 60 per cent by 2030. For Japan, the scenario assumes a reduction in net debt to 80 per cent of GDP.
Source: International Monetary Fund, April 2011 *World Economic Outlook*

Chart 8: Sovereign risk indicators remain very high for peripheral euro-area countries

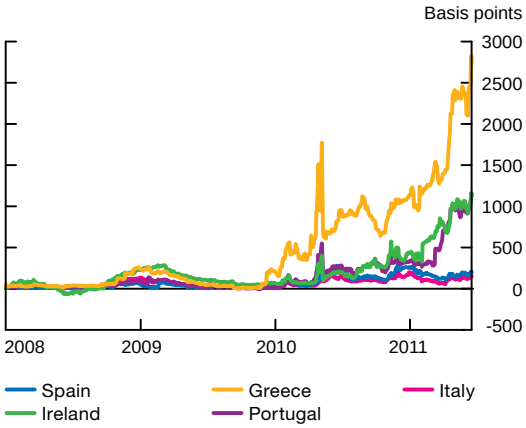
Spreads on 5-year sovereign credit default swaps



Source: Markit Last observation: 17 June 2011

Chart 9: Borrowing costs have surged for Greece, Ireland and Portugal

2-year sovereign yield spreads over German bonds



Source: Bloomberg Last observation: 17 June 2011

In the near term, fiscal strains are the most acute for the euro-area periphery

The December FSR was published against a backdrop of renewed broad-based tensions in euro-area sovereign funding markets, triggered by market concerns over the acute problems besetting Ireland's banking sector. Since then, investors have begun to better position themselves for a potential credit event. While spreads on credit default swaps remain very high for peripheral euro-area countries (**Chart 8**), there is now a clearer delineation between jurisdictions. Spreads have risen for governments perceived as having the most severe fiscal strains—Greece, Ireland and Portugal, in particular—but have been more stable for other highly indebted governments, including those of Italy and Spain. Borrowing costs for Greece, Ireland and Portugal at the 2-year maturity have surged since December (**Chart 9**). As of 17 June, government bond yields in Greece are nearly 2,700 basis points above those in Germany—the benchmark for euro-area sovereigns. This spread is also very high for Ireland and Portugal, at about 1,100 basis points. Spreads at these high levels suggest that markets perceive a high probability of default or restructuring in the near term.

Sovereign risk and persistent weakness in the European banking sector could have spillover effects elsewhere, including Canada

As illustrated by the recent experiences in Ireland and Spain, where problems in the banking sector were an important driver of fiscal tensions, sovereign risk and bank vulnerabilities are interconnected in important ways. For example, as economic conditions deteriorate, banks could experience significant losses on both direct holdings of sovereign debt and on their loan portfolios. For their part, undercapitalized banks can raise sovereign funding costs by creating significant contingent liabilities for governments.

Concerns over the quality of sovereign debt in countries experiencing severe fiscal strains could lead to heightened tensions in debt markets for other highly indebted countries. This could result in perceptions of heightened counterparty risk for banks, even those that have only indirect exposure to this debt through their connections with other institutions. As institutions become less willing to extend funding to each other, global bank funding markets could be severely disrupted. These problems could also escalate into a generalized retrenchment from risk in the global financial system, affecting a wide range of markets.

As discussed in **Box 1**, the Canadian financial system is not immune to the tensions that are currently affecting European markets. Even though the direct exposure of the Canadian banking sector to credit claims on entities from the most vulnerable countries is low, domestic banks could face losses on loans to other countries whose banks are more exposed to the affected jurisdictions. Nonetheless, the most likely contagion channel for the Canadian financial system would be through a generalized retrenchment from risk and the related impact on the cost or availability of funding.

Box 1

Mapping the Exposure of the Canadian Banking Sector to Peripheral Europe

Since the total claims of the Canadian banking sector on either public or private sector entities from Greece, Ireland, Portugal and Spain are small (**Chart 1-A**), Canadian banks would face only limited losses from these exposures, even under severe assumptions.

However, potential losses associated with these claims account for only a small portion of the overall risk to the Canadian banking sector arising from unsustainable sovereign debt burdens in the euro-area periphery. The total exposure of Canadian banks to the euro-area periphery results not only from their claims on entities from Greece, Ireland, Portugal and Spain, but also from exposures to other entities that are themselves exposed to these countries. The high degree of interconnectedness in the international banking system can thus amplify shocks.

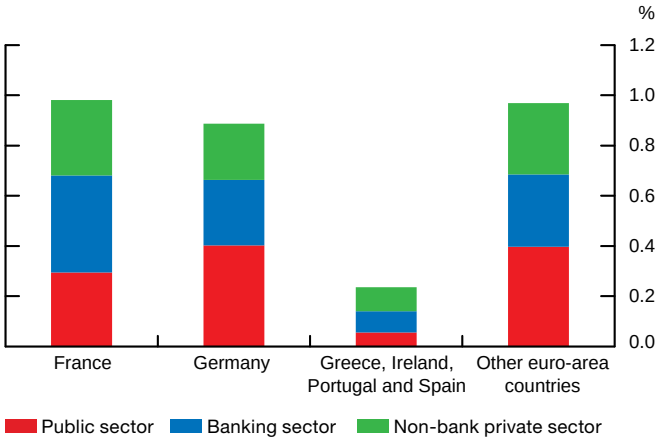
Chart 1-B shows banking sector claims between the most vulnerable countries from peripheral Europe, in aggregate, and the United States, the United Kingdom, France and Germany. It also shows claims between these countries and Canada. To illustrate, direct claims of the U.S. banking sector on Greek, Irish, Portuguese and Spanish banks, corporations and governments were about US$111 billion in the fourth quarter of 2010. These claims, which represent approximately 1 per cent of the total assets in the U.S. banking system, increase the exposure of the Canadian banking sector to the euro-area periphery because of the aggregate claims of domestic banks on U.S. entities amounting to roughly US$521 billion—or 18 per cent of the total assets of Canada's banking sector.

Two important caveats should be borne in mind when using foreign claims to assess the vulnerability of the banking sector in a given country to an adverse shock in another jurisdiction. First, while foreign claims are helpful to gauge potential second-round effects, these effects cannot be quantified with these data alone. The financial strength of the individual banks with direct exposures to the entities from which an adverse shock originates must also be taken into account in order to assess the banks' ability to absorb this shock.

Second, potential off-balance-sheet exposures, such as those arising from derivatives contracts at positive market value, guarantees extended, and credit commitments are not included in foreign claims. Hence, Chart 1-B could understate total exposures.

Chart 1-A: Canadian banks' direct claims on the euro-area periphery are low . . .

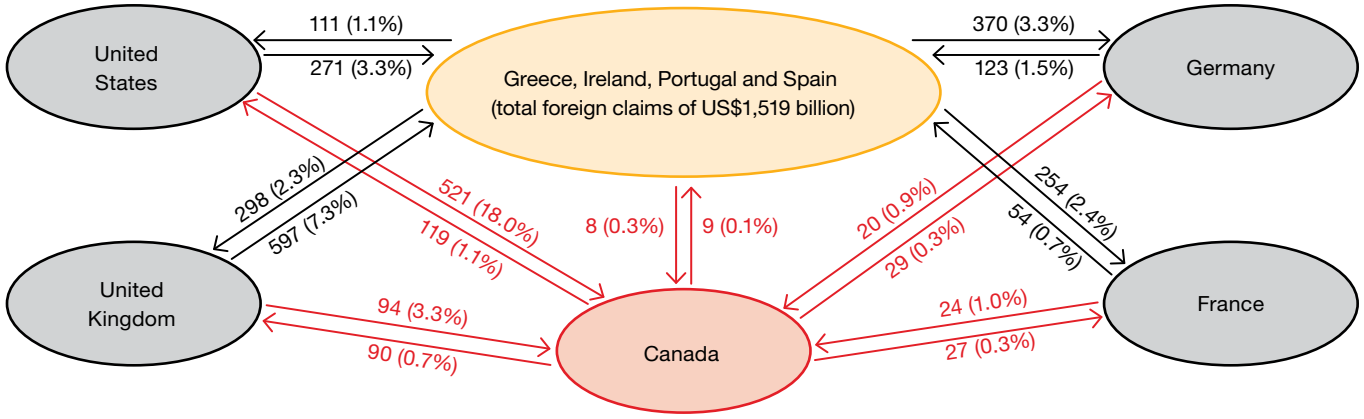
Foreign claims of Canadian banks as a percentage of total assets, 2010Q4



Sources: Bank for International Settlements and regulatory filings by Canadian banks

Chart 1-B: . . . but Canadian financial institutions have larger claims on countries that are exposed to these jurisdictions

Foreign claims of banks, in US$ billions and as a percentage of total assets in the banking sector of the recipient country (in parentheses), 2010Q4



Note: Cross-border claims are expressed on an ultimate-risk basis. Red lines represent bilateral foreign claims between Canada and other countries. Data on bank claims and assets are from samples that may differ slightly.

Sources: Bank for International Settlements, Bank of Canada, U.S. Federal Reserve and European Central Bank

To date, policy actions have been insufficient to address the challenges facing peripheral Europe and have failed to instill confidence in markets

There have been several constructive policy developments in Europe in recent months (**Table 3**). Of note, facilities to provide financial assistance to highly indebted governments within the euro area were enhanced in late March. Key changes include: an expansion in the effective lending capacity of the temporary European Financial Stability Facility; the establishment of the permanent European Stability Mechanism; and a 100-basis-point reduction in the interest rate paid by Greece on loans from the financial stability facilities.

Nevertheless, such official support must go hand in hand with credible fiscal consolidation in highly indebted countries. There has been persistent skepticism in markets about prospects for both the implementation of the required measures to achieve a sustainable path for fiscal policy and for the realization of the associated macroeconomic projections. In this context, there has been considerable debate about whether a debt restructuring may be needed in one or more of the most vulnerable countries from peripheral Europe. This might entail, for example, reducing debt-servicing costs, extending the maturities of debt instruments or lowering the amount of debt outstanding. Debtholders may agree to carry out such a restructuring on a voluntary basis, with a view to alleviating immediate financing pressures. In the case of an involuntary restructuring designed to lower the net present value of debt, coordinating an agreement with the various debtholders is likely to be difficult and protracted, particularly in the absence of collective-action clauses. The uncertainty associated with a possible restructuring, which is reflected in the pricing of the debt of governments from peripheral Europe, could hamper the functioning of markets more generally.

Addressing the challenges facing highly indebted countries will be a lengthy and complex process. While credible and timely deficit reduction will be difficult to achieve over the medium term, it is essential to reduce the threat that sovereign risk poses for financial stability. Given the central role of government liabilities

Table 3: Timeline of key events in the European sovereign debt crisis

Date	
28 November 2010	European Union (EU) agreement to support financial package for Ireland
5 January 2011	European Financial Stability Facility (EFSF) issues €5 billion bond in support of Ireland
28 January 2011	Agreement on pension reform in Spain
18 February 2011	Restructuring of financial sector in Spain
11 March 2011	Agreement to strengthen the EFSF
18 March 2011	Release of methodology for European banking stress test
24–25 March 2011	Establishment of European Stability Mechanism
31 March 2011	Release of bank stress-test results for Ireland
6 April 2011	Request for financial assistance from Portugal
20 May 2011	IMF-EU approve €78 billion assistance program for Portugal

in the financial system, prolonged concerns over sovereign risk could be particularly damaging, potentially undermining their role as benchmarks for pricing a broad array of financial assets. This could have far-reaching consequences, including higher borrowing costs for individuals and firms, less-diversified portfolios, and greater volatility in asset markets. Alleviating these concerns requires a combination of credible fiscal consolidation and multilateral support to fulfill the near-term funding needs of those countries at a cost that is compatible with fiscal sustainability. Given the potential for vulnerabilities in the banking sector to reinforce sovereign risk, it is also imperative that weak financial institutions be addressed in a timely and credible manner to mitigate this feedback loop. As will be discussed in greater detail, the European stress tests are an important step in this direction.

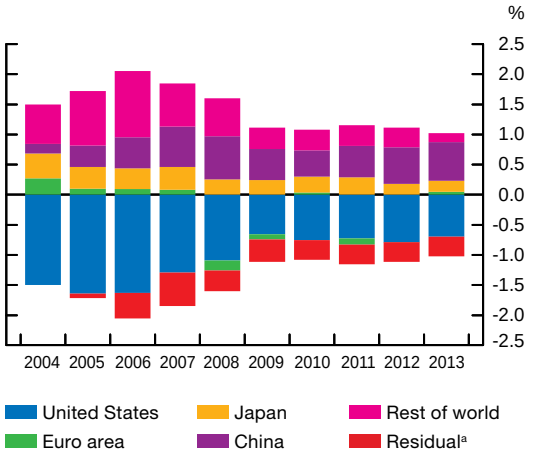
Global Imbalances

Large current account imbalances cannot persist indefinitely. Given the substantial cross-border flows associated with external imbalances, there is a risk that their resolution will be disorderly, perhaps associated with an abrupt slowdown in the accumulation of U.S.-dollar official reserves by surplus economies or a reduced willingness by private investors to invest across borders. Such a disorderly resolution could involve a sharp adjustment in exchange rates, higher risk premiums for a wide range of assets, and/or a decline in real economic activity. A disorderly adjustment would place major stress on financial institutions, particularly those with already-weak balance sheets and/or with imperfectly hedged cross-border exposures and funding strategies.

Since December, the G-20 countries have taken concrete measures to strengthen their co-operation in promoting the orderly and timely resolution of global imbalances. However, a sustained rebalancing of global demand is bound to be protracted. While current account imbalances have declined since the onset of the crisis, they are projected to remain large through 2013 (**Chart 10**). The longer the adjustment is delayed, the greater the risk of a disorderly resolution. This risk remains at a high level and is broadly unchanged since December.

Chart 10: Global current account imbalances are projected to remain large through 2013

Current account balance as a percentage of world GDP, annual data



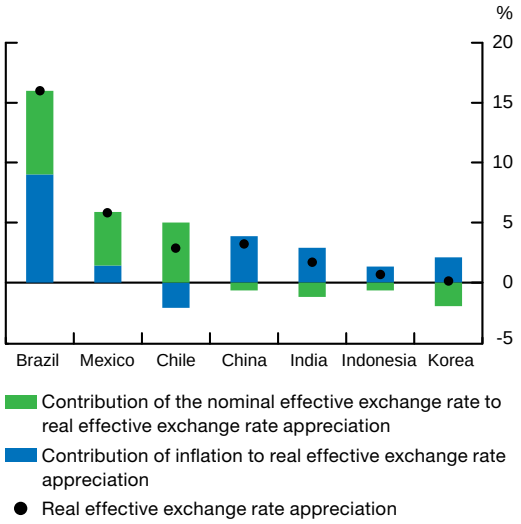
a. The residual represents the statistical error and has been kept constant at its last historical value over the projection period.
Sources: International Monetary Fund and Bank of Canada
April 2011 *Monetary Policy Report* Last data plotted: 2013

Resolving imbalances requires adjustments by both deficit and surplus countries

A durable unwinding of external imbalances requires that the United States and other deficit countries increase savings in a timely and sustained manner. While household savings have risen in some deficit countries—particularly in the United States—since the onset of the crisis, these savings have been more than offset by higher public sector deficits. Hence, the increase in aggregate savings that is required in deficit countries to resolve global imbalances has not materialized. This will be a long process, given the sizable adjustment necessary to repair both government and household balance sheets in these economies. A greater share of their aggregate demand will necessarily have to come from exports to economies with current account surpluses, particularly the emerging economies of Asia. Thus, the resolution of global imbalances requires these latter countries to undertake structural reforms to bolster internal sources of demand in order to rely less on exports for future growth.

Chart 11: Rising inflation rates in some Asian economies are contributing to the appreciation of their real effective exchange rates

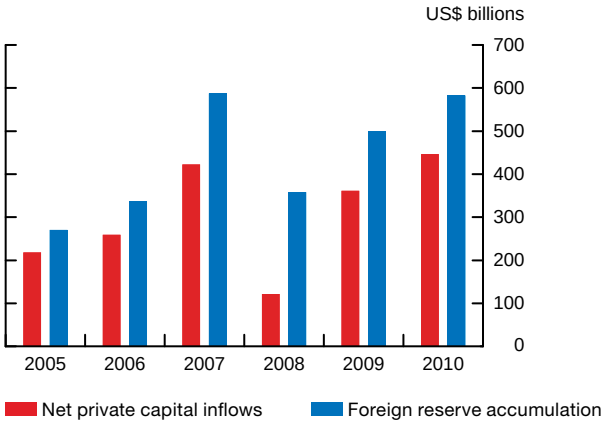
Change from 2010Q1 to 2011Q1



Source: J. P. Morgan

Chart 12: Private sector capital inflows to emerging Asian economies are being more than offset by government outflows

Capital inflows and reserve accumulation in emerging Asia



Source: Institute of International Finance Last observation: 2010 (estimate)

In recent years, stimulative monetary policy, large capital inflows and credit booms have resulted in strong domestic demand in most large Asian emerging-market economies. However, the rebalancing of demand has thus far been frustrated by exchange rate policies in Asia: the real appreciation of most Asian currencies has been insufficient, and rising inflation rates in some of the major emerging-market economies of Asia are contributing to the adjustment in real effective exchange rates (**Chart 11**).

Capital flows into emerging-market economies are contributing to a buildup of domestic financial imbalances in recipient countries

Emerging-market economies as a whole are experiencing strong capital inflows owing to their vigorous growth and positive interest rate differentials relative to advanced economies. In Asia, these inflows are currently more than offset by government outflows as countries seek safe and liquid markets for their foreign reserves (**Chart 12**).

Given the limited depth of financial markets in many recipient countries, these capital flows are raising concerns about the ability of these markets to absorb the incoming funds. Until financial markets in emerging-market economies develop further, there is thus a risk that continued large inflows could fuel asset-price bubbles in these countries.

There is also a risk that these sizable capital inflows could reinforce excess demand in the major emerging-market economies. Overheating in these countries could undermine the stability of the international financial system. For example, high credit growth, rapid infrastructure development and soaring house prices suggest that China may be at risk of a boom-bust cycle. To illustrate this risk, the Bank of Canada conducted a model-based simulation of a boom-bust scenario for China in which Chinese interest rates are increased sharply to combat an unanticipated rise in asset prices and inflation. Given China's prominent role as an end-user of commodities, this scenario entails a significant decline in commodity prices. This shock would be transmitted internationally through direct trade links, lower investor confidence, and falling prices for financial assets which, taken together, could result in financial contagion. Global economic growth would slow markedly, declining by approximately 1 percentage point to less than 3 per cent in 2012. This model did not capture second-round effects in financial markets—such as asset fire sales or margin calls—that could lead to an even more severe outcome. Although illustrative and partial in nature, this exercise serves to emphasize the importance of a timely and sustainable rotation of the global sources of demand.

Firm implementation of G-20 commitments is essential to support global financial stability

Inflation pressures in many emerging-market economies are a sign of the policy challenges they face and highlight the need for greater adjustment. While some countries have enacted further capital controls and macroprudential measures, these are not sustainable substitutes for sound macroeconomic policy. A more

restrictive policy stance that includes greater exchange rate flexibility is needed to manage domestic demand and mitigate strains on the financial system.

Leaders of the G-20 countries have committed to the implementation of policies consistent with facilitating a durable and orderly narrowing of external disequilibria. To this end, they have enhanced the G-20 Mutual Assessment Process by developing guidelines for the timely identification of persistently large external imbalances and have agreed to assess the nature of such imbalances, as well as the root causes of the factors impeding adjustment. While implementing the structural reforms necessary for a sustained reduction in global imbalances will be challenging, the agreements reached by the G-20 are important steps in the right direction.

Protracted Recovery in Advanced Economies

As already noted, while the global economic recovery is expected to continue at a steady pace, risks to the outlook remain elevated. Repairing the balance sheets of banks, households and governments in advanced economies will take considerable time. Furthermore, accommodative monetary policies, capital inflows and ample credit are fuelling strong demand in some major emerging-market economies. There is a risk that overheating in emerging-market economies could disrupt the recovery in advanced economies.

Since the onset of the global financial crisis, the majority of the world's banks have made substantial progress in strengthening their balance sheets. Banks in Canada and other major advanced economies have raised the proportion of higher-quality capital on their balance sheets and have reduced their reliance on wholesale funding markets (**Chart 13**). Improvements have, however, been uneven. Some segments of the global banking system are lagging behind, with thin capital buffers and high exposures to underperforming assets.

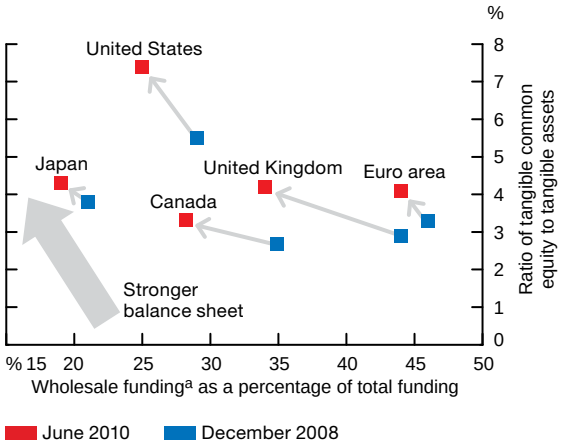
The risk that a protracted recovery in the advanced economies could delay progress in solidifying the international financial sector remains elevated, given the remaining challenges in terms of structural adjustment. This risk is broadly unchanged since December.

Concerns over asset quality continue to cloud the outlook for the global banking sector

The global recovery has led to a decline in recent quarters in the overall level of provisions for loan losses for the global banking sector as a whole (**Chart 14**). Nonetheless, concerns over the quality of bank assets remain, owing primarily to exposures to both residential and commercial real estate. Such exposures weigh on the prospects of banks in Spain, Ireland, the United States and the United Kingdom in particular.

A turnaround in property markets is necessary for the quality of these assets to improve. The outlook for these markets is linked in part to employment prospects and the strength of household balance sheets. If an adverse shock occurs in either of these areas, asset quality at banks would likely deteriorate further. Two

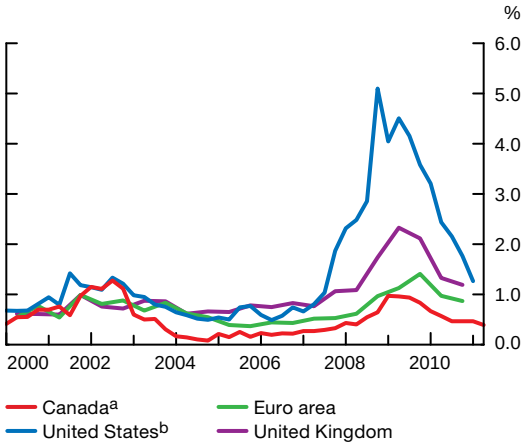
Chart 13: Since the end of 2008, reliance on wholesale funding has declined, and the capital positions of international banks have improved



a. Wholesale funding includes debt and interbank borrowing. Total funding is wholesale funding plus deposits.
Sources: IMF April 2011 *Global Financial Stability Report* and regulatory filings by Canadian banks

Chart 14: Provisions for loan losses are trending downward

Provisions for loan losses as a percentage of total loans (annualized)

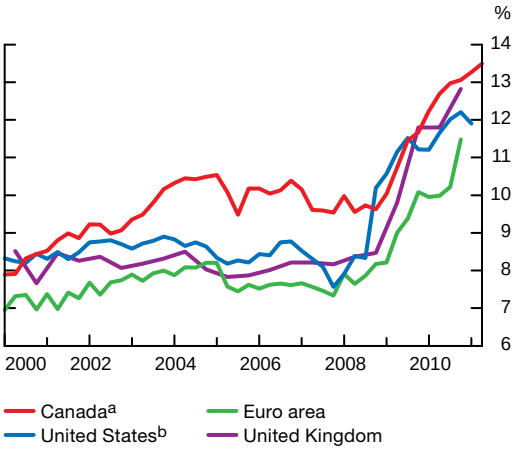


a. Data for Canadian banks are based on their fiscal year (FY 2011Q2 ended in April).
b. U.S. data exclude Goldman Sachs, Merrill Lynch and Morgan Stanley.
Source: Bloomberg

Last observations: Canada 2011Q2
United States: 2011Q1
Other countries: 2010Q4

Chart 15: Capital ratios continue to rise around the world

Average ratio of Tier 1 capital to risk-weighted assets

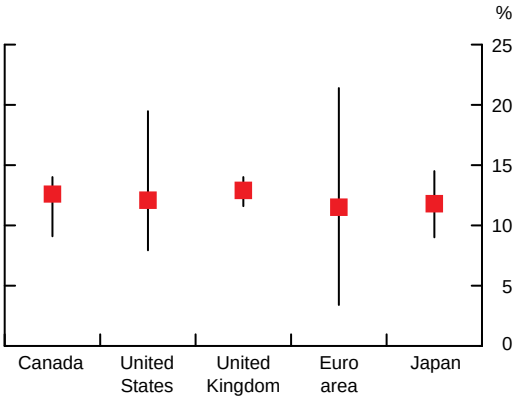


a. Data for Canadian banks are based on their fiscal year (FY 2011Q2 ended in April).
b. U.S. data exclude Goldman Sachs, Merrill Lynch and Morgan Stanley.
Source: Bloomberg

Last observations: Canada 2011Q2
United States: 2011Q1
Other countries: 2010Q4

Chart 16: The distribution of banks' Tier 1 capital ratios is uneven across jurisdictions

Maximum, median and minimum Tier 1 capital ratios of large banks by region, 2010Q4



Note: The vertical lines represent the maximum and minimum Tier 1 capital ratios for a group of representative sample banks in each region (8 Canadian banks, 48 U.S. banks, 5 U.K. banks, 80 euro-area banks and 12 Japanese banks). The red square represents the median.
Source: Bloomberg

factors are increasing this vulnerability. First, extraordinarily low interest rates appear to have allowed some banks to roll over loans that would otherwise have been considered delinquent. For instance, forbearance levels in the United Kingdom appear to have risen as banks have revised repayment terms for mortgage borrowers in difficulty. Exposures to commercial and residential real estate are especially susceptible to such forbearance. Second, banks in the United States in particular have accumulated a large stock of properties through foreclosures. They now face the challenge of liquidating these properties without adding to the stresses on still-fragile real estate markets.

In addition, large and concentrated exposures to countries in peripheral Europe undermine the credit quality of the loan portfolios of large banks in other jurisdictions, particularly Belgium, France and Germany.

While banks around the world have made further progress in raising capital ratios (**Chart 15**) and reducing leverage in recent years, improvements have been uneven. In some jurisdictions, the ratio of Tier 1 capital to risk-weighted assets varies considerably across institutions, especially in the euro area and the United States (**Chart 16**).

Reliance on wholesale funding is leaving the global banking sector vulnerable to shifts in sentiment . . .

Using wholesale funding to finance their activities leaves financial institutions more vulnerable to shifts in market sentiment than other sources of funding, such as retail deposits. When debt comes due for renewal or new funding is required, an institution may unexpectedly find that it faces adverse market conditions. Disruptions in fixed-income markets can generate a sharp rise in the cost of funding or lead to reduced access to required funding for financial firms. Moreover, the shorter the maturity of wholesale funding sources, the lower the resilience of funding positions in times of market stress.

Wholesale funding currently makes up a significant portion of funding by banks in advanced economies, including Canada. In addition, banks around the world have considerable debt maturing in the next few years. The IMF estimates that US$3 trillion of total bank debt is maturing by the end of 2012. This may impede access to funding for weaker institutions.

The funding costs of Canadian banks remain lower than those of many of their international peers. Despite their relative strength, Canadian banks could be adversely affected if a deterioration in international macrofinancial conditions has a negative effect on Canada's economic outlook or on market perceptions about the creditworthiness of domestic banks.

. . . and some recent trends in the composition of wholesale funding represent a potential risk for financial stability

There has recently been a resurgence in the issuance of covered bonds, particularly by European banks. In the current environment, where many institutions are perceived to be somewhat vulnerable, this reflects a preference by investors for securities

that are collateralized in order to reduce credit risk.[3] Anecdotal evidence also suggests that the amount of collateral required by investors as a safeguard against losses has risen. The growing reliance on funding secured by assets raises the risk of insufficient assets for senior, unsecured debtholders and deposit insurance schemes in the event of a resolution. This could also impede the effectiveness of resolution frameworks based on the conversion of senior debt into capital (i.e., bail-in debt) if the pool of eligible assets is insufficient. In Canada, the Office of the Superintendent of Financial Institutions (OSFI) issued guidelines in 2007 limiting covered-bond issuance to 4 per cent of assets. In addition, the Government of Canada recently released a consultation paper outlining proposed legislation for a covered-bond framework.[4]

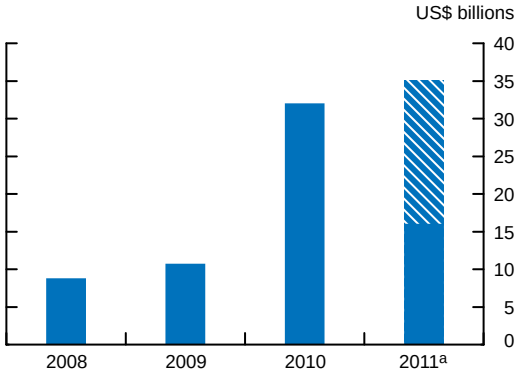
Some foreign banks, particularly in Europe, are also increasing their use of puttable certificates of deposit (**Chart 17**), which, under certain circumstances, allow the holder of the security to demand early repayment of the principal on short notice. This implies that liquidity can be withdrawn swiftly in times of stress. While this feature supports the issuance of unsecured debt by allowing investors to reduce their risk, it could exacerbate shortages of liquidity for the issuing banks in times of stress, possibly introducing a channel for contagion. It also amplifies interest rate risk for the issuers.

More needs to be done to strengthen the global banking sector

The most urgent priority for improving the international banking system is to recapitalize or, where necessary, resolve weak banks. The European banking sector in particular appears to contain some undercapitalized financial institutions. Efforts are currently under way to address this situation. For example, the banking sectors in both Germany and Spain have been significantly consolidated: capital levels have been increased, assets revalued and business models adjusted to be more sustainable over the long term. The European Union stress test under way is an opportunity to improve the identification of weak banks. But, to be effective in alleviating the systemic risk arising from the euro-area banking sector, appropriate action must be taken in a timely manner to address identified vulnerabilities.

It is also critical to complement these immediate actions with the timely implementation of the numerous reforms aimed at strengthening the financial sector—for example, raising capital buffers, improving the quality of capital and reducing leverage. In the context of the above discussions on current risks, banks should also be encouraged to extend maturities and reduce their reliance on funding in wholesale markets.

Chart 17: Issuance of U.S.-dollar-denominated puttable certificates of deposit by European banks has increased markedly



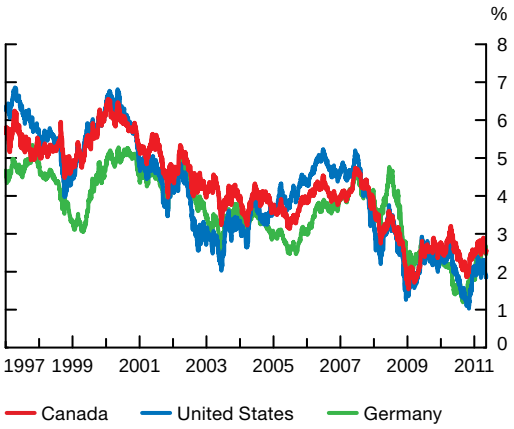
a. To allow comparisons with past years, data for 2011 have been estimated (blue diagonal lines). It is assumed that the volume of issuance up to 17 June is maintained for the remainder of the year.
Source: Bloomberg Last observation: 17 June 2011

3 The European Stability Mechanism, which comes into effect in 2013, will push unsecured debt further down the creditor list in the event of default—in effect reducing recovery levels for these investors. This has further enhanced the attractiveness of covered bonds that are backed by specific pools of collateral. In addition, since covered bonds are eligible under the proposed liquidity coverage ratio being considered by the Basel Committee on Banking Supervision, they may provide additional benefits to issuing banks.

4 This consultation paper is available at <http://www.fin.gc.ca/activty/consult/cb-os-eng.asp>.

Chart 18: Government yields have increased since December, but remain low by historical standards

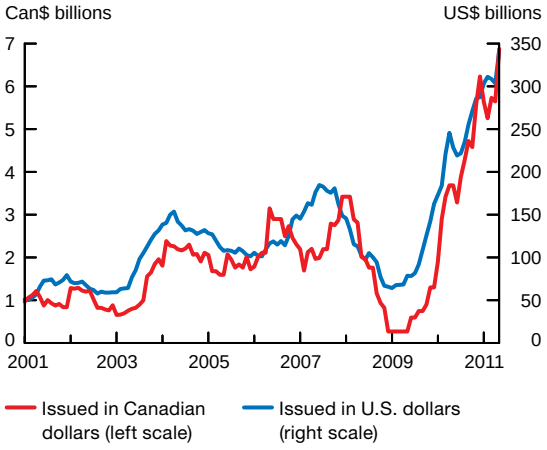
Yields on 5-year government bonds



Source: Bloomberg Last observation: 17 June 2011

Chart 19: High-yield bond issuance reached record levels in 2010 in both U.S.-dollar and Canadian-dollar markets

High-yield bond issuance by corporations, 12-month moving average



Source: Bloomberg Last observation: May 2011

Low Interest Rate Environment in Major Advanced Economies

Although interest rates have risen since December, they remain at extraordinarily low levels in the major advanced economies (**Chart 18**), owing to policy rates that are at or near historical lows in most jurisdictions and to unconventional monetary policy stimulus in the United States, the United Kingdom and Japan. Markets are pricing in the likelihood that this situation will continue for some time. While accommodative monetary policy is necessary to support the global economic recovery and to achieve price stability objectives, sustained low interest rates can provide the impetus for more aggressive risk-taking behaviour. Expectations that interest rates will remain low for a long time can breed complacency, with investors willing to take on exposures to risky assets that they may not be able to manage effectively if conditions become less benign in the future. Investors holding assets that entail exposure to credit risk may not demand proper compensation for potential losses. Moreover, investors may seek to boost returns by employing additional leverage, which can amplify their exposure to both interest rate risk and credit risk.

Low funding costs may diminish the sense of urgency for banks to take losses on impaired assets, thus perpetuating the weakness in the global banking system discussed in the previous section. In particular, there are concerns that low interest rates may allow banks to exercise forbearance by revising repayment terms for borrowers in difficulty. Since writing off assets erodes capital, banks with weak capital positions have a particular incentive to roll over and extend impaired loans.

Evidence of risk-taking in the global financial system has continued to mount since December. The stability of the Canadian financial system could be undermined if risk becomes underpriced or if investors build up large exposures that they are unable to manage. While this risk has grown since December, it remains moderate. Although misalignments in asset prices are difficult to detect, there are no signs that current valuations are out of line with history, with the exception of some riskier assets. There is also no evidence of material concentrations of risk across the financial system. Nonetheless, the management of risk must be carefully monitored in order to identify possible dislocations early and mitigate their potentially destabilizing consequences in a timely manner.

Risk tolerance in financial markets is rising . . .

The growing popularity of riskier financial instruments is evident in issuance, pricing and flow data across a range of markets. Bond issuance by non-investment-grade corporations reached record levels in 2010 in both Canadian-dollar and U.S.-dollar markets (**Chart 19**). So far this year, the issuance of high-yield bonds has remained quite robust and, if high-yield issuers raise funds in capital markets over the rest of 2011 at the same pace as they did from January to May, the record totals from last year will be surpassed.

Yields on non-investment-grade bonds are at or near historical lows in the United States and Canada (**Chart 20** and **Chart 21**). The market price for credit risk—measured by the spread between high-yield debt and government bonds—is also low by historical standards, although it is still above the all-time trough reached in 2007. This is partly the result of the improved economic outlook. But it is also possible that the entry into this market of non-traditional investors in search of higher returns has helped to drive yields lower than warranted by the issuer's underlying fundamentals. For example, retail investors in the United States continue to invest heavily in mutual funds that specialize in high-yield debt. In Canada, the number of investors participating in new issues of high-yield bonds has also increased substantially recently. It is uncertain whether all new investors have the ability to adequately manage the risks associated with these securities and investment strategies.

Even though global equity markets have broadly lost ground since April, most indexes are still higher than in December and volatility measures (such as the VIX index) are low, owing to a combination of healthy earnings growth, a reduction in equity risk premiums and expectations that the pace of the international economic recovery will remain steady. The ratio of stock prices to historical earnings suggests that equity valuations are broadly in line with the historical norm (**Chart 22**). Nonetheless, an increase in financial leverage has contributed to rising stock prices in the United States: margin debt on the New York Stock Exchange (NYSE) has been trending upward since February 2009 and is approaching the levels seen before the onset of the financial crisis (**Chart 23**).

. . . and financial instruments with a riskier and more complex structure are returning

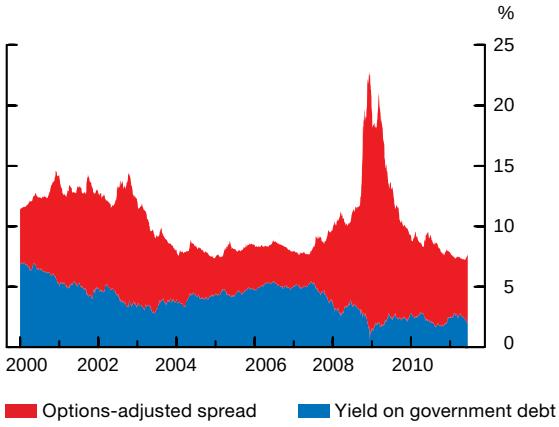
The recent resurgence of covenant-lite loans (**Chart 24**) is another indicator that risk tolerance is rising. Unlike traditional loans, a covenant-lite loan does not generally require issuers to maintain certain financial conditions—for example, with respect to their leverage. Thus, it is possible for firms with deteriorating financial positions to delay default, which may ultimately lower recovery values to lenders.[5] In the United States, US$30 billion of covenant-lite loans were issued in the first three months of 2011. If this volume of issuance is maintained over the remainder of the year, the record amount of US$97 billion issued in 2007 would be surpassed. In early 2011, these instruments accounted for a record share of the overall issuance of syndicated loans. Vigilance is required to determine whether lenders are loosening their lending standards, even though anecdotal evidence suggests that, in comparison with the situation before the crisis, such loans are now reserved for higher-quality borrowers.

Changes to the structure of exchange-traded funds (ETFs) are an additional manifestation of the underlying search for yield in international markets that can be a possible source of systemic risk. A new type of complex ETF that uses financial leverage and asset swaps to replicate the underlying pool of securities has

5 For further analysis, see "Covenant-Lite Loans May Prove Riskier in the Next Downturn," by Moody's (March 2011).

Chart 20: Yields on non-investment-grade corporate debt are close to all-time lows in the United States . . .

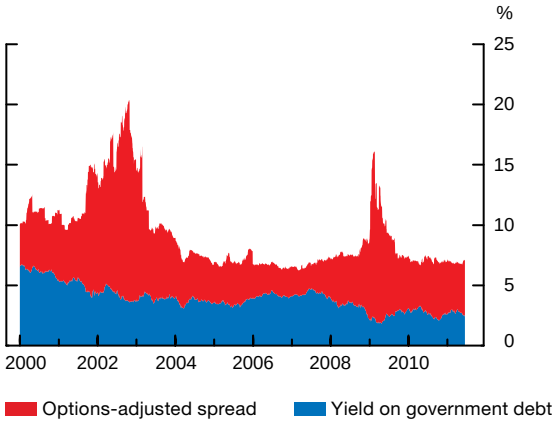
Decomposition of yield to maturity on high-yield bonds issued by corporations in U.S. dollars



Sources: Bloomberg, Bank of America Merrill Lynch and Bank of Canada calculations Last observation: 17 June 2011

Chart 21: . . . and in Canada

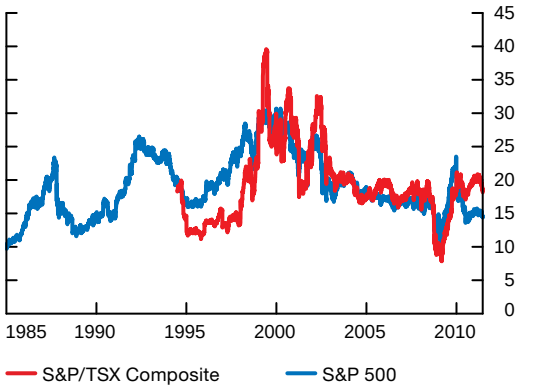
Decomposition of yield to maturity on corporate high-yield bonds issued by Canadian corporations in Canadian dollars



Sources: Bloomberg, Bank of America Merrill Lynch and Bank of Canada calculations Last observation: 17 June 2011

Chart 22: Equity valuations are broadly in line with historical averages in advanced economies

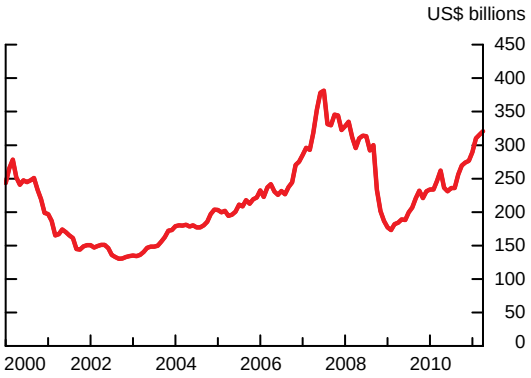
Ratio of equity prices to 1-year realized earnings



Source: Bloomberg Last observation: 17 June 2011

Chart 23: Margin debt on the New York Stock Exchange has been trending upward

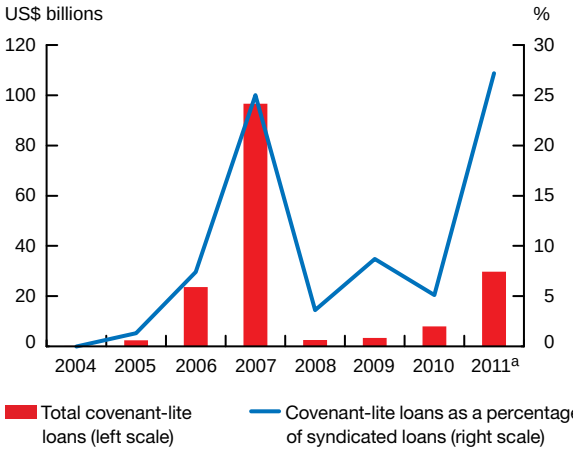
New York Stock Exchange margin debt[a]



a. Amount borrowed by investors from brokers to purchase securities on the New York Stock Exchange

Source: New York Stock Exchange Last observation: April 2011

Chart 24: There has been a resurgence of covenant-lite loans in recent months

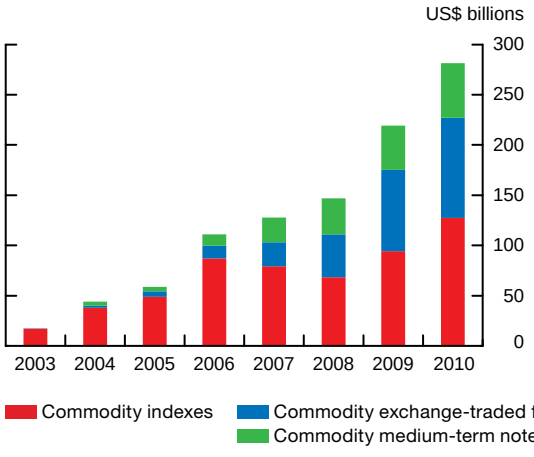


a. Year to date

Source: Standard & Poor's Last observation: 10 March 2011

Chart 25: Financial flows into commodities have increased sharply since the middle of the last decade

Cumulative flows



Source: Barclays Last observation: 2010

emerged. The complexity and opacity of the structure of these instruments may leave investors exposed to risks they do not understand.[6] To date, this is mainly a European development, owing partly to regulation that allows managers of investment funds to use derivatives. According to the Financial Stability Board, synthetic instruments currently account for around 45 per cent of the European ETF market. This market segment is not material in Canada.

The search for higher returns has reinforced the growing popularity of commodity markets among investors

Since the middle of the last decade, financial instruments with returns linked to an underlying pool of commodities, such as commodity exchange-traded funds and medium-term notes, have risen in popularity, making it easier for investors to gain exposures to these markets (**Chart 25**). The search for higher returns is reinforcing this trend, particularly in light of rising prices for a wide range of commodities in recent years.[7]

While investors' exposures to swings in commodity prices are higher than in the past, it is unclear whether they are sufficient to cause financial instability. A number of risks are nonetheless associated with increased financial flows in commodity markets. First, should the recent rise in commodity prices prove unsustainable, the resulting market correction could cause portfolio losses. Second, lack of knowledge about this new asset class may complicate risk management. Third, investors could overestimate the liquidity of these markets in a stress event. As we have seen in past crises, a lack of liquidity in times of stress can result in significant losses and contagion across markets as investors are forced to sell assets to meet margin requirements.

Life insurance companies and defined-benefit pension funds may be particularly prone to excessive risk-taking behaviour in a low interest rate environment

It is not known how exposures resulting from the recent increase in risk-taking are distributed across the financial system. Given the long duration of their liabilities, however, life insurance companies and defined-benefit pension funds are adversely affected by a sustained period of low interest rates. By reducing yields on assets and raising the net present value of liabilities, such an interest rate environment makes guaranteed returns and benefits owed to policyholders and pension plan members more difficult to fulfill. Accounting practices will influence the speed at which this is recognized in their financial

6 For example, in contrast with traditional ETFs, which are backed by physical assets, investors in synthetic ETFs are exposed to additional credit risk, since repayment of asset swaps depends on the creditworthiness of the counterparty to these swaps. In addition, there may be a misalignment of incentives among stakeholders, given the potential for a conflict of interest arising from the dual role of some banks as both ETF provider and derivatives counterparty. For more details on the risks posed by synthetic ETFs, see "Potential Financial Stability Issues Arising from Recent Trends in Exchange-Traded Funds (ETFs)" by the Financial Stability Board. The report is available at <http://www.financialstabilityboard.org/publications/r_110412b.pdf>.

7 Surveys of the attitudes of investors in commodity markets conducted by Barclays show that, between 2005 and 2011, the proportion of respondents mentioning the search for higher absolute returns as the main motivation for this investment doubled, reaching 40 per cent.

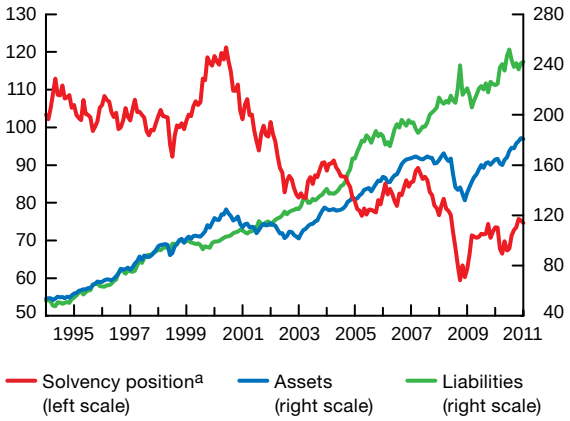
statements: the more closely the discount rate is linked to market rates, the more immediate the effect of low interest rates on balance sheets.[8]

Insurance companies and pension plan sponsors have numerous options for weathering the adverse effects of low interest rates on their financial positions. They could, for example, adapt their business strategies by raising the prices of products with minimum return guarantees or by increasing premiums and contributions. They could also reduce their interest rate sensitivity with derivatives, move into riskier assets in a search for yield or lengthen the duration of their assets to reduce maturity mismatches between assets and liabilities.

In recent years, low interest rates have indeed put pressure on the financial positions of life insurers and pension plans, both in Canada and in other advanced economies, and they continue to do so. Nonetheless, Canadian insurance companies and pension funds have, so far, managed the challenges stemming from low interest rates relatively well. While the balance sheets of some Canadian life insurers continue to be somewhat strained, the average level of capital remains well in excess of regulatory minimums. Moreover, the Mercer index on the health of defined-benefit pension plans in Canada suggests that, after being eroded for the better part of the past decade, their aggregate solvency position has improved slightly since 2009, owing to higher returns on assets after the crisis (**Chart 26**). Still, the average pension plan remains underfunded. Both categories of investors would face further challenges if interest rates remain low for an extended period.

Chart 26: The aggregate solvency of defined-benefit pension funds in Canada has improved slightly since 2009

Indexes (December 1998 = 100)



a. Solvency position is equal to assets divided by liabilities.
Source: Mercer (Canada) Limited Last observation: March 2011

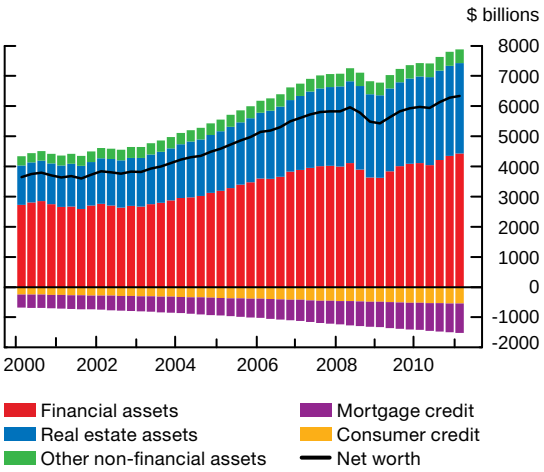
Risk-taking behaviour must be carefully monitored so that any resulting buildup of financial imbalances can be identified early

The financial crisis provided ample evidence of the far-reaching consequences that can occur when investors do not fully understand the risks they have assumed. Developments in the Canadian third-party asset-backed commercial paper market in the summer of 2007[9] provide a telling example. It is therefore imperative that financial market participants carefully assess the risks they are exposed to, taking into account credible expectations for the macroeconomic environment—including interest rates—over the full investment horizon. This requires

8 Like other Canadian firms, insurers will move to International Financial Reporting Standards (IFRS) during 2011. The International Accounting Standards Board (IASB), the organization responsible for developing IFRS, is preparing IFRS 4, a new standard applying to insurance contracts. Implementation is targeted for 2013. The IASB's initial proposals have caused considerable concern within the Canadian life insurance industry, as well as among many foreign insurers and supervisory agencies. While intended to promote greater transparency and comparability in financial statements, it appears likely that the new standard would also lead to greater volatility in financial statements. This may affect market assessments, company valuations and the ease with which an insurer secures capital. These proposals are still under discussion, with the IASB expected to issue a new proposal in the near future.

9 In August 2007, Canadian issuers of third-party asset-backed commercial paper had difficulty rolling over maturing securities, owing to heightened concerns in markets about the quality of the underlying assets. With non-bank-sponsored conduits unable to draw on backup liquidity lines from banks, a standstill was called to enable an orderly workout.

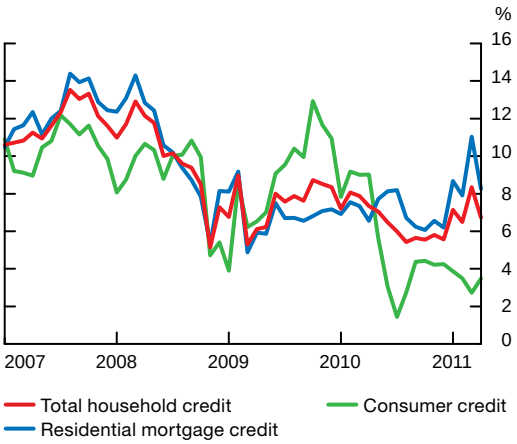
Chart 27: Household net worth continued to move up in the first quarter of 2011



Note: Liabilities are shown as negative figures.
Sources: Statistics Canada and Bank of Canada calculations
Last observation: 2011Q1

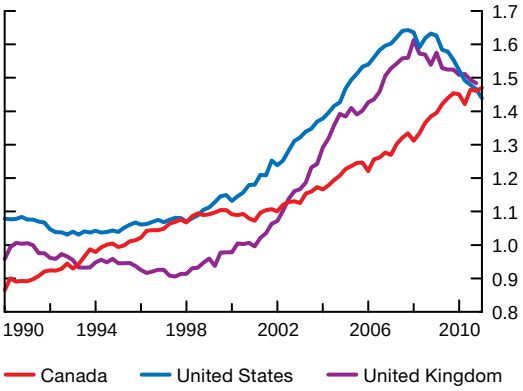
Chart 28: The pace of household debt accumulation has increased in 2011

Annualized 3-month growth rates



Source: Statistics Canada
Last observation: April 2011

Chart 29: The aggregate debt-to-income ratio of Canadian households is at a record level



Sources: Statistics Canada, U.S. Federal Reserve and U.K. Office for National Statistics
Last observation: 2011Q1

that information on financial instruments be readily available to participants in an easily accessible format. This documentation should allow investors to identify the factors that influence price changes in the instrument, as well as those that might result in significant losses.

Canadian Household Finances

The vulnerability of Canadian households to adverse economic shocks has risen in recent years as their debt loads climbed steadily in relation to income. The growing vulnerability of this sector increases the risk that a shock to economic conditions would be transmitted to the broader financial system via a deterioration in the credit quality of household loans. The resulting increase in loan-loss provisions and the reduced quality of the remaining loans could lead to tighter credit conditions and, in turn, to mutually reinforcing declines in real activity and in the overall health of the financial sector.

This risk remains elevated and is broadly unchanged since December. Further sustained moderation in debt accumulation is required to stop the rise in the vulnerability of households to a deterioration in the macroeconomic environment. Nonetheless, with the economic recovery expected to continue at a steady pace in Canada, the probability of a labour market shock is deemed to have edged somewhat lower.

Household credit has grown rapidly since December . . .

Household net worth continued to move up in the first quarter of 2011, supported by price gains for financial assets, as well as for non-financial assets such as real estate (**Chart 27**).

After moderating to a pace closer to the growth in disposable income in the last quarter of 2010, debt accumulation has picked up this year, with total household credit rising at an annualized rate of 7.5 per cent over the first four months of 2011, driven primarily by a 9.1 per cent increase in residential mortgage credit (**Chart 28**). As a result, the aggregate household debt-to-income ratio edged up to a new record level (**Chart 29**). The recent increase in the growth of credit was supported by temporary factors. As noted in **Box 2**, in January 2011, the Government of Canada announced additional measures to strengthen the rules for government-backed insured mortgages (phased in from mid-March to mid-April). These changes likely brought forward some mortgage activity that would otherwise have taken place later in the year. Credit growth so far in 2011 has also been stimulated by strong sales of existing homes in late 2010. Since activity in the resale market has slowed recently, this effect should also dissipate over the coming months.[10] Overall, these factors suggest that the growth of household credit will likely moderate from the pace observed in early 2011 to a rate closer to that of disposable income.

10 Typically, there is a 3- to 6-month lag between the sale of a house and when that activity is reflected in the mortgage credit data. This lag reflects the average closing period on a house sale.

Box 2

Fostering the Stability of the Canadian Mortgage Market

Since 2008, the Government of Canada has introduced a series of changes to the rules for government-backed insured mortgages. These changes were aimed at supporting the long-term stability of the housing market.

In the first set of changes, introduced in October 2008, the maximum amortization period for new government-backed insured mortgages was lowered from 40 to 35 years, and the maximum loan-to-value ratio for new mortgages was reduced to 95 per cent (from 100 per cent).

In April 2010, the maximum loan-to-value ratio for refinanced mortgages was lowered to 90 per cent of the value of the house (from 95 per cent), and the minimum down payment on properties not occupied by the owner was raised to 20 per cent (from 5 per cent). A more stringent qualifying test for insured mortgages was also introduced: all borrowers are now required to meet the standards for a 5-year fixed-rate mortgage, even if they choose a mortgage with a variable interest rate and/or a shorter term.

In January 2011, the government announced further measures to strengthen the rules for new government-backed insured mortgages. They are:

- a reduction from 35 to 30 years in the maximum amortization period;
- a decline from 90 to 85 per cent for the maximum loan-to-value ratio when refinancing a mortgage; and
- the withdrawal of government-backed insurance on lines of credit secured by houses.

The adjustment to the mortgage insurance guarantee framework came into force in mid-March, while the withdrawal of government insurance backing on home equity lines of credit became effective in mid-April.

. . . and the credit-to-GDP gap remains well above its historical average

Even with an improved economic outlook, households cannot continue borrowing indefinitely at a rate that exceeds the growth of disposable income. While the household credit-to-GDP gap has declined from the peak reached in 2009, it remains elevated. The aggregate credit-to-GDP gap, whose fluctuations have recently been driven mainly by household credit, is an indicator of broad leverage in the economy that has been effective in providing early warnings of financial stress. **Box 3** discusses how this indicator is used for monitoring macrofinancial developments.

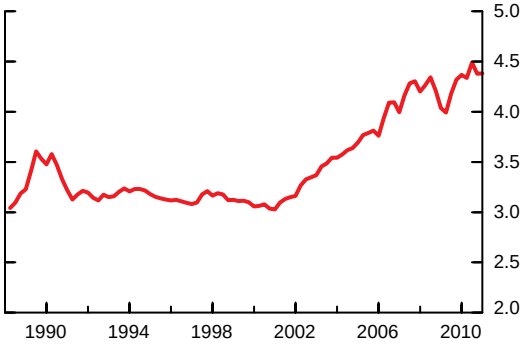
If recent trends continue, the household sector would become more vulnerable

Some moderation in the accumulation of household debt is expected. However, income growth is also likely to be subdued in coming years, owing to both fiscal consolidation and a slow recovery in average hours worked. Hence, credit growth may still exceed the rise in household income, and the aggregate household debt-to-income ratio could thus continue to increase over the near term.

Moreover, Canadian house prices remain elevated relative to income (**Chart 30**), although the impact on housing affordability (measured by mortgage payments as a share of income) has been offset by historically low mortgage rates (**Chart 31**). Housing would be less affordable if interest rates were closer to longer-run norms (as shown by the measure calculated with

Chart 30: House prices in Canada are still elevated relative to income . . .

Ratio of Teranet-National Bank house price index to household disposable income[a]



a. The Teranet-National Bank house price index is used from 1999 onward. Before 1999, house prices consistent with that index were estimated by the Bank of Canada.
Sources: Statistics Canada, Teranet-National Bank and Bank of Canada calculations
Last observation: 2011Q1

Box 3

The Credit-to-GDP Gap

The recent financial crisis has prompted new research on quantitative early-warning signals of a buildup in vulnerabilities that could lead to significant financial system stress. This work is still in its infancy. International evidence suggests, however, that the deviation of the private sector credit-to-GDP ratio from its trend value (otherwise known as the credit-to-GDP gap) has been a particularly useful indicator in foreshadowing periods of financial stress. As a result, the Basel Committee on Banking Supervision (BCBS) supports the use of the credit gap as a guide to help authorities identify periods of potential stress to the banking sector.[1]

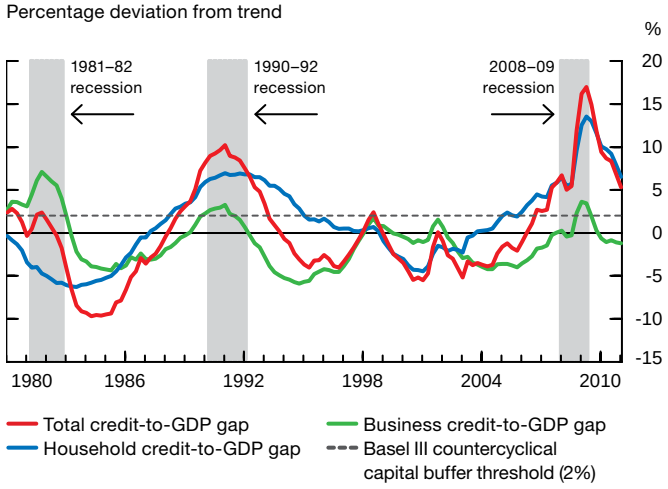
Chart 3-A presents the credit-to-GDP gaps for Canada over the past 30 years, using measures based on total private sector credit and on household and business credit alone. Prior to a financial crisis, the credit-to-GDP gap tends to rise, typically because of rapid growth in lending. The onset of a recession will often temporarily reinforce the increase in the gap, as GDP growth slows and becomes negative. It is difficult to specify precisely at which level the gap indicates that there is a significant likelihood of future financial stress, but the BCBS recommends that authorities enhance their monitoring of credit dynamics when the gap is higher than 2 per cent (shown as a horizontal dotted line in Chart 3-A).

Prior to the financial crisis, credit-to-GDP gaps were rising in Canada. The credit-to-GDP gap for both total and household credit reached a level of around 5 per cent in 2007, while it was near zero for business credit. While the global financial crisis did not originate in Canada, the higher gaps suggest that the vulnerability of Canada's financial system to foreign crises had increased. During the crisis in 2008–09, the total and household credit-to-GDP gaps rose sharply as real GDP in Canada fell and credit continued to grow at a robust pace. With economic activity recovering in subsequent quarters, the gaps declined. However, this decline has been slow, owing to the sustained strong growth in total domestic credit—especially household credit—and both the total and household credit-to-GDP gaps remain well above the 2 per cent threshold. In contrast, the business credit-to-GDP gap is slightly below zero, suggesting that business credit is growing at a pace that is broadly in line with its historical trend relative to GDP.

In the first quarter of 2011, the household credit-to-GDP gap in Canada was around 5 per cent. This does not necessarily indicate that serious financial problems are forthcoming, but it is a strong argument for continued heightened monitoring of the dynamics in household credit. The measure of the credit-to-GDP gap will likely be refined over time, but the BCBS emphasizes that no single indicator is sufficient for monitoring and predicting developments in the financial system. In practice, the Bank of Canada draws upon a wide range of information that is being enhanced through ongoing research.

Chart 3-A: Total and household credit-to-GDP gaps have declined but remain high

Percentage deviation from trend



Sources: Statistics Canada and Bank of Canada calculations

Last observation: 2011Q1

1 This guide will be used in the context of the new countercyclical capital buffer that is being introduced under the Basel III accord. For a discussion on the application of this guide in Canada, see "The Countercyclical Bank Capital Buffer: Insights for Canada," on page 29 of the December 2010 FSR.

a 4 per cent floor for real mortgage rates). After declining in the second half of 2010, the Teranet-National Bank house price index has risen since December. Nonetheless, property price gains are unlikely to support household wealth in the future as much as they have in recent years.

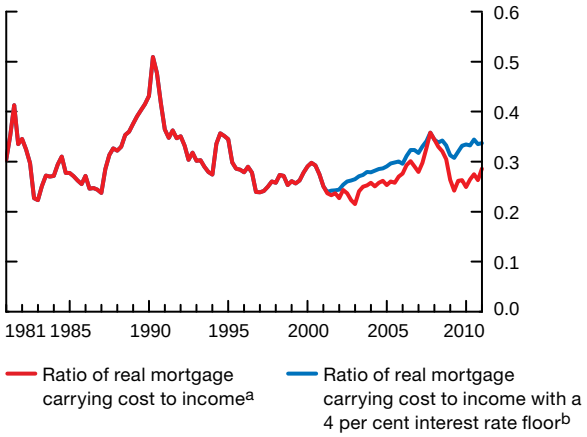
Household loans in arrears would roughly double under a stress test involving a hypothetical labour market shock

The Bank has updated the stress-test simulation reported in the December 2010 FSR to assess the potential impact of an adverse labour market shock on the financial situation of Canadian households and the banking sector.[11] This simulation involves two steps. First, the evolution of the distribution of the household debt-service ratio (DSR) is simulated until the second quarter of 2013. The simulated DSR for each household is conditional on assumptions about the future growth path of household debt, income and interest rates. The distribution is then used to assess how the share of vulnerable households (i.e., those with a DSR equal to or greater than 40 per cent[12]) and the proportion of the total debt they owe will evolve over the simulation period. Second, given the resulting distributions, the impact of a hypothetical labour market shock at the end of the simulation period on the proportion of household loans in arrears for three months or more is estimated.[13]

Household debt is assumed to grow at a rate broadly consistent with recent trends (**Table 4**). Given the anticipated labour market dynamics mentioned earlier, it is assumed that income grows at a more moderate pace over the simulation period. The differential between the growth rates of debt and income implies that the aggregate debt-to-income ratio for Canadian households continues to rise over the simulation period, reaching 158 per cent by the second quarter of 2013. The hypothetical interest rate profile that is assumed is consistent with market expectations as of mid-June.[14] The labour market shock entails a 3-percentage-point rise in the unemployment rate and a six-week increase in the average duration of unemployment. The magnitude of the shocks to the unemployment rate and to the duration of unemployment is calibrated to replicate those experienced in Canada during the recession of the early 1990s.

In this simulation scenario, the proportion of indebted households with a DSR of 40 per cent or more would rise to 7.5 per cent in the second quarter of 2013, compared with 6.4 per cent in 2010 (**Table 5**). The proportion of the total debt owed by these households would increase from 12.3 per cent to 12.7 per cent by the end of the simulation period. Finally, the unemployment shock would

Chart 31: . . . although mortgage payments as a share of income remain low in the current interest rate environment



a. This measure estimates the size of mortgage payments for a representative household, given prevailing interest rates and house prices, and then scales this value by personal disposable income in order to measure affordability.
b. To illustrate affordability if interest rates were closer to historical norms, the average real mortgage rate since 1995 (4 per cent) is used to set a floor for the real interest rate; if the observed value is below 4 per cent in a period, the floor is used in the calculation.
Source: Bank of Canada calculations Last observation: 2011Q1

11 The simulation was conducted with microdata from Ipsos Reid's *Canadian Financial Monitor*. The methodology is outlined in "The Bank of Canada's Analytic Framework for Assessing the Vulnerability of the Household Sector," on page 57 of the June 2010 FSR.

12 Consistent with industry standards, a DSR of 40 per cent is the threshold above which a household is considered more likely to have difficulty making loan payments.

13 A loan is assumed to be in arrears when the sum of a household's income from employment insurance (where applicable) and the value of its holdings of liquid assets are not sufficient to make loan payments for a period of at least three months. In this exercise, liquid assets are defined as chequing and savings accounts, term deposits, guaranteed investment certificates and a proportion of mutual fund holdings.

14 The term premium for mortgage rates (i.e., the slope of the yield curve) is assumed to stay near current levels, while the risk premium (i.e., the difference between mortgage rates and the respective yield on Government of Canada bonds) is assumed to fall gradually from current levels toward its historical average over the simulation period. This change in the risk premium, together with the slow pass-through of interest rate changes to fixed-rate mortgages, results in effective borrowing rates remaining relatively stable over the simulation period.

Table 4: Assumptions for simulation of the debt-service ratio

Period	Market expectations of 1-week rate (%)	Effective household borrowing rate (%)	Annualized growth rate of household income (%)	Annualized growth rate of household credit (%)
2011Q1	1.0	5.2	3.0	8.4
2011Q2	1.0	5.0	3.5	6.9
2011Q3	1.0	4.9		6.5
2011Q4	1.1	4.9		
2012Q1	1.2	4.9		
2012Q2	1.3	4.9		
2012Q3	1.5	5.0		
2012Q4	1.6	5.0		
2013Q1	1.7	5.0		
2013Q2	1.8	5.0		

Note: The effective interest rate of households is a weighted average of interest rates on various mortgages and consumer loans.

Table 5: Simulation results

	Proportion of indebted households with DSR≥40% (%)	Proportion of debt owed by households with DSR≥40% (%)	Proportion of household loans in arrears three months or more (%)
2010 (observed)	6.4	12.3	0.7
2013Q2	7.5	12.7	1.5[a]

a. Loans in arrears with a 3-percentage-point increase in the unemployment rate
Source: Bank of Canada simulations

increase the proportion of loans in arrears at domestic financial institutions to 1.5 per cent (compared with 0.7 per cent in 2010).[15,16] These results are broadly in line with those from the exercise reported in the December 2010 FSR.

Since a number of simplifying assumptions were necessary to conduct the simulation, the results are purely illustrative. This partial simulation exercise does not attempt to capture any of the additional repercussions of an economic downturn severe enough to trigger such a labour market shock. Other features of the model may cause the results to overstate the rise in the arrears rate.[17] Nevertheless, the results continue to highlight the need for banks to carefully consider the aggregate risk of their total household exposures. The stress test also underlines the need for households to assess their ability to service their debt loads over the entire maturity spectrum of their loans.

15 Since the December 2010 FSR, the observed proportion of loans in arrears has been changed to include off-balance-sheet assets.

16 An alternative scenario assumed a 200-basis-point increase in the household risk premium starting in the third quarter of 2012. This rise in the risk premium is gradually passed through to the effective borrowing rate. Measures of vulnerability are higher at the end of the simulation period, but the impact of the unemployment shock on loan arrears is not materially different from that of the main scenario.

17 The model does not account for the possibility that households may use pre-approved limits on personal lines of credit and credit cards to meet their financial needs during a period of unemployment. While accumulating more debt would increase the vulnerability of these households to future shocks, it may nonetheless prevent them from becoming insolvent in the near term. In addition, our model does not allow households to avoid insolvency by selling less-liquid assets.

Safeguarding financial stability

Policy-makers around the world have taken a range of forceful actions in recent years to support the recovery from the global financial turmoil and to improve the resilience of the financial system. However, as highlighted throughout this issue of the FSR, some fragilities remain that require continued focus, monitoring and commitment. A failure to address these fundamental vulnerabilities in a coordinated and disciplined manner could lead to a further buildup of financial imbalances and potentially derail progress achieved to date.

The most pressing policy issue internationally is to continue addressing the remaining legacy problems associated with the global financial crisis, including high sovereign debt burdens and weakened bank balance sheets in many advanced economies. Most governments have already announced fiscal consolidation plans and have taken initial steps to implement them. It is essential that all governments with unsustainable debt burdens continue to adopt concrete measures to stop the rise in public debt and, ultimately, to reduce sovereign debt according to a carefully chosen timeline that does not impede the economic recovery. In the euro area, an important immediate challenge is to reduce funding costs for countries subject to increased market pressure. To achieve this, fiscal consolidation has been complemented by financial assistance from the International Monetary Fund and the European Financial Stability Facility. In particular, Greece, Ireland and Portugal have received loans to alleviate short-term funding needs. This financing permits countries with acute debt challenges to undertake fiscal consolidation in an orderly manner and within a suitable time frame.

Strengthening the balance sheets of banks that remain undercapitalized and have underperforming assets also requires urgent attention. Policy-makers need to identify weak banks and ensure that those that are viable take the necessary steps to improve capital levels and write off bad loans, with assistance from the public sector as necessary. Financial institutions that are not viable need to be restructured or resolved in an orderly manner. Stress tests under way in the euro area will help identify institutions that require further attention.

To make the financial sector more resilient over the medium term, momentum must be maintained to implement, within an appropriate time frame, the comprehensive regulatory reform agenda agreed to by G-20 leaders. In particular, international reforms to capital and liquidity standards in the banking sector will be phased in so that banks can adjust to the new requirements while supporting the economic recovery. Work is also under way to foster the development of contingent-capital and bail-in debt instruments that would be converted into common equity, either in the relatively early stages of financial distress (i.e., going-concern) or when a bank is on the verge of failure (i.e., gone-concern).[18] In addition, authorities are working actively toward enhancing resolution tools so that even the largest banks

18 For more information on contingent capital and bail-in debt, see "Contingent Capital and Bail-In Debt: Tools for Bank Resolution," on page 51 of the December 2010 FSR.

at the core of the financial system can be resolved safely and without government support when they are no longer viable. A credible resolution framework for all financial institutions helps mitigate moral hazard and strengthens market discipline.

In addition to the reforms aimed at the banking sector, reducing the likelihood and consequences of future episodes of turmoil requires that global financial markets operate on a sounder foundation. Establishing stronger infrastructures that would be resilient in times of stress is an important priority in this regard. In Canada, the introduction of central counterparty services for both over-the-counter derivatives and fixed-income securities, including repurchase agreements, is being actively pursued. It is also essential that policy-makers rigorously monitor the development of innovative financial instruments and that the perimeter of regulation is adjusted, where appropriate, so that all financial markets and institutions are regulated according to the risk they represent. Some minimal transparency requirements are needed for all financial instruments to allow investors to perform due diligence. Prospectuses and information memoranda must be made readily available and should include information in plain language on the structure of the instrument and the risks that would affect its performance.

The reports included in this issue of the FSR elaborate on these topics. These reports examine access to central counterparties for over-the-counter derivatives, as well as the potential risks for financial stability arising from the development of market-based financing (often referred to as “shadow banking”) and high-frequency trading.

Safeguarding financial stability over the medium term requires firm implementation of the G-20 commitments to co-operate in promoting an orderly, timely and sustained resolution of global imbalances. The indicative guidelines for identifying external imbalances that were agreed upon by G-20 finance ministers and central bank governors in April are an important milestone, but further actions are needed. In particular, surplus economies need to undertake reforms to reduce their reliance on external demand on a sustained basis, while deficit countries need to bolster national savings. Market-oriented exchange rates that reflect underlying fundamentals are also necessary to facilitate this adjustment.

In Canada, the elevated debt loads of the household sector require continued vigilance. The important measures taken by the Government of Canada in recent years to strengthen underwriting practices for government-backed insured mortgages are starting to have an impact. These are outlined in Box 2 on page 21. When taking on debt, households must bear the ultimate responsibility for ensuring that they can service that debt in the future. It is also essential that financial institutions actively monitor the ability of households to repay their loans over time. The Bank is co-operating closely with other federal authorities to continuously assess the risks arising from the financial situation of the household sector.

Reports

Reports examine selected issues of relevance to the financial system.

Introduction

The need to strengthen the regulatory framework and infrastructure for financial markets, while keeping pace with innovation, was reinforced by the recent global financial crisis. This section of the *Financial System Review* includes two reports on issues relevant to work under way internationally to address some of the causes of the crisis: inadequate oversight in some countries for market-based financing (MBF) (often referred to as the "parallel," "shadow" or "unregulated" banking sector) and failures in managing counterparty risk in over-the-counter (OTC) derivatives markets. A third report examines implications for financial stability arising from high-frequency trading in international financial markets.

In the report, **Emerging from the Shadows: Market-Based Financing in Canada**, James Chapman, Stéphane Lavoie and Lawrence Schembri explore the role played in the financial crisis by financial markets that provide credit-intermediation activities similar to those performed by banks. They provide an overview of MBF activities in Canada and review the reforms that have been proposed both in Canada and abroad to ensure that such activities are appropriately regulated in view of the risks they represent.

To prevent OTC derivatives markets from being a channel of contagion, as they were during the crisis, G-20 leaders have made a commitment that all standardized OTC derivatives transactions will be cleared through central counterparties (CCPs) by the end of 2012. This commitment presents difficulties for countries like Canada that are not home to the important existing global CCPs, since the access of their financial institutions to these CCPs may be limited. In the report, **Access to Central Clearing Services for Over-the-Counter Derivatives**, Joshua Slive, Carolyn Wilkins and Jonathan Witmer explore some of the potential unintended consequences of limited access to CCPs and suggest two strategies for addressing them.

In **The Growth of High-Frequency Trading: Implications for Financial Stability**, William Barker and Anna Pomeranets look at both the benefits and the potential risks to the financial system arising from the growing popularity of trading techniques that rely on computers to execute transactions at high speeds.

Emerging from the Shadows: Market-Based Financing in Canada

*James Chapman, Stéphane Lavoie and Lawrence Schembri**

Introduction

The global financial crisis has brought market-based financing (MBF) out of the shadows and into the limelight. MBF refers to credit-intermediation activities similar to those performed by banks. Like bank intermediation, these activities involve maturity or liquidity transformation, possibly with some degree of leverage, but they are conducted primarily via markets rather than within financial institutions (although in many instances a bank is involved at some point in the intermediation chain). The MBF sector is often referred to as the "parallel," "shadow" or "unregulated" banking sector, because MBF intermediation activities are subject to a different regulatory framework, and typically are not prudentially regulated and supervised to the same extent as the traditional intermediation activities performed by banks (Financial Stability Board 2011a).[1] For the purpose of this article, we define MBF to include intermediation activities that are closer in nature to traditional bank intermediation and to exclude conventional corporate debt or equity financing, since those activities do not incorporate significant maturity or liquidity transformation. The MBF sector is defined to encompass bank-like intermediation activities, as well as the related markets and their participants.

The MBF sector can bring significant economic benefits to the overall financial system and to the economy. It contributes to efficient funding and the transfer of credit risk. It also provides competition to the traditional banking sector and can diversify credit sources available in the economy, possibly allowing creditworthy borrowers to obtain credit that they might not have been able to obtain otherwise. Thus, if the associated risks—including both credit risk and liquidity risk—are properly managed, MBF can be a welfare-enhancing financial innovation. But the MBF sector involves a wide range of activities with different levels of benefits and risk. At the riskier end of the continuum are highly complex, opaque and levered securities, such as some of the non-bank-sponsored asset-backed commercial paper (ABCP) that existed before the crisis. In contrast, government-guaranteed mortgage-backed securities (MBS), such as the National Housing Act (NHA) MBS program operated by the Canada Mortgage and Housing Corporation (CMHC), while considered part of the MBF sector based on the above definition, lie at the less-risky end of the range because of their lack of embedded leverage and the government guarantees that eliminate credit risk.

Because parts of the MBF sector played a significant role in the financial crisis in advanced countries, the sector warrants a closer review.[2] The purpose of this article is threefold: (i) to provide an overview of MBF in Canada, highlighting its key characteristics; (ii) to examine potential vulnerabilities that could have a material impact on systemic risk; and (iii) to review possible reforms that have been proposed in Canada and abroad, drawing on lessons from the crisis.

MBF activities are significant in several advanced countries, and are comparable in size to traditional lending activities performed by the regulated banking sector. In Canada, the most prominent MBF activities are repurchase (repo) agreements, government-guaranteed securitized mortgages, asset-backed securities (ABS) involving consumer credit receivables, and short-term wholesale

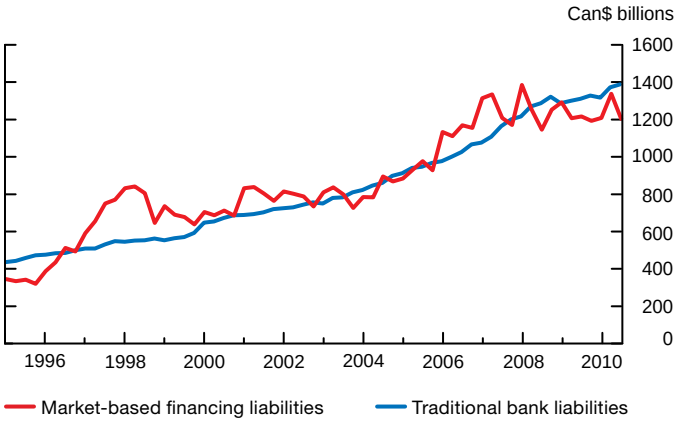
* This report was prepared with the research assistance of Derrick Schroeter.

1 Paul McCulley (2007) was the first to use the term "shadow banking" at the 2007 Jackson Hole Central Bank Conference, but Raghuram Rajan (2005) had identified the vulnerabilities associated with this sector at the same conference two years earlier.

2 Shleifer (2010) reviews the debate on the role of MBF in the U.S. financial crisis.

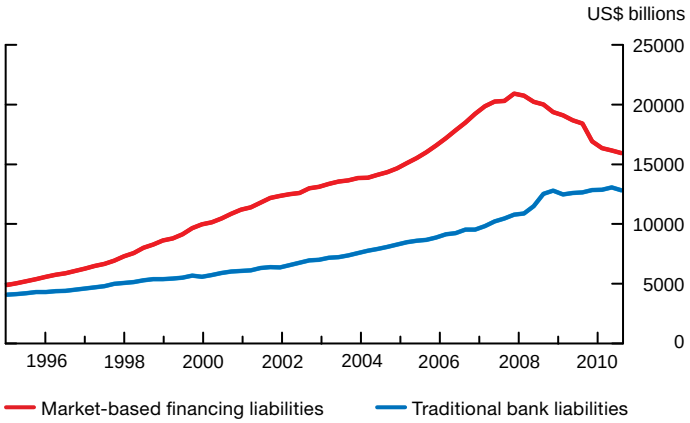
Chart 1: MBF liabilities vs. traditional bank liabilities

Canada



Notes: MBF liabilities include short-term debt instruments, repos, NHA MBS, special-purpose corporations and shares of money market mutual funds outstanding. Traditional bank liabilities are the sum of gross deposits, subordinated debt and foreign currency deposits at Canadian chartered banks.
Source: Bank of Canada Last observation: 2010Q3

United States



Notes: MBF liabilities include short-term debt instruments, repos, net securities loaned by funding corporations, total liabilities of government-sponsored enterprises and pool securities, total liabilities of ABS issuers, and shares of money market mutual funds outstanding. Traditional bank liabilities are the total liabilities of the commercial banking sector, as per the flow of funds data.
Source: U.S. Federal Reserve Last observation: 2010Q4

funding. Although the crisis caused the growth of MBF activities to slow, and even reverse in some jurisdictions, overall, MBF has expanded significantly over the past 15 years in advanced countries, most notably in the United States and the United Kingdom, but also in Canada. This growth has largely been determined by financial innovation and the expansion and deepening of financial markets.

Before the crisis, MBF activities were more pervasive and generally riskier in the United States than in Canada, and represented a significant source of systemic risk. In Canada, one segment of the MBF sector, the non-bank-sponsored ABCP market, experienced a severe disruption during the crisis, while other segments such as the repo market and the mortgage-backed securities market performed relatively well.[3]

As a result of the crisis, reforms to the MBF sector are being considered at the international level, under the auspices of the Financial Stability Board (FSB).[4] These reform efforts are also driven by concerns about potential regulatory arbitrage, owing to the implementation of tighter capital, liquidity and leverage rules for the regulated banking sector under Basel III. These tougher requirements could increase the incentive for financial activities to move to the MBF sector. If left unchecked, this development could lessen the benefits of financial reforms in terms of the reduction of systemic risk. The work of the FSB (2011a) will focus on three issues: to define the sector; to develop the data and methodology to systematically monitor the sector; and to review a set of feasible policy options. Any regulatory reforms aimed at MBF will have to strike a balance, however, between expanding the perimeter of regulation to manage the risks associated with activities in the MBF sector and maintaining an environment for beneficial competition and financial innovation that enhances the efficiency and resilience of financial intermediation.

Key Characteristics of MBF

One of the main features of MBF is its rapid growth over the past 15 years (**Chart 1**). While most of the forces driving the growth of MBF are beneficial, others may increase systemic risk. Clearly, the desire to realize efficiencies in hedging, diversification and credit intermediation is responsible for much of the innovation in financial activities. More worrisome are financial innovations driven by regulatory arbitrage or, in other words, by the desire to circumvent existing regulation. For example, the securitization of non-conventional residential mortgages in the United States was caused, in part, by bank capital requirements that encouraged banks to take these assets off their balance sheets, yet maintain liquidity support for the securitization vehicles, resulting in imperfect risk transfer. There are other examples in which financial innovation occurs for a particular purpose, and then the new instrument is repackaged, often with leverage, to boost its expected return, which also increases its risk. For example, commercial paper was originally developed to allow firms to finance short-term funding requirements, but then ABCP was issued to finance the securitization of

3 Kamhi and Tuer (2007) provide an analysis of the collapse of the non-bank ABCP market.

4 At the Seoul Summit in November 2010, the G-20 leaders asked the FSB to develop recommendations to strengthen the regulation and oversight of the shadow banking system by mid-2011.

longer-term assets. ABCP paid a higher expected return, but it was also subject to more risk. The MBF sector is constantly evolving over time in response to the effects of financial innovation and regulatory changes.

While competitive market forces generally produce outcomes that are welfare enhancing in normal times, the absence of public oversight, guarantees and liquidity backstops can increase the vulnerability of the MBF sector to shocks, which could result in financial panics (similar to bank "runs"), market failures and, in turn, systemic risk.[5] These vulnerabilities are likely to be exacerbated when the financial activities are motivated primarily by regulatory arbitrage.

Another key characteristic of MBF is its heterogeneity within and across countries. In Canada, the key activities are: (i) collateralized short-term borrowing and lending of cash and securities via repos; (ii) issuance of securitized debt instruments backed by pools of individual loans such as credit card receivables, car and student loans, and residential and commercial mortgages; and (iii) wholesale short-term borrowing and lending. These activities are conducted through the repo market, the market for mortgages and other ABS, and the markets for commercial paper and other short-term debt instruments issued by financial and non-financial corporations (e.g., bankers' acceptances, ABCP). The financial institutions involved in MBF activities include both regulated and unregulated institutions that directly participate in these activities, such as banks, securities dealers, hedge funds and money market mutual funds (MMMFs), and institutions that facilitate MBF activities, such as credit-rating agencies (CRAs) and mortgage insurers.[6] MBF also varies across jurisdictions, depending on the structure and regulation of the banking system.

Comparing the MBF sector in Canada and the United States

Total activity in the MBF sector in Canada and the United States, as measured by liabilities outstanding, has increased three to four times since 1995 (**Chart 1**).[7]

Interestingly, in Canada, the volume of MBF activities has generally increased at the same pace as traditional bank-intermediation activities and, since 1999, has been approximately the same size, reflecting the important role of banks in MBF. In comparison, the MBF liabilities outstanding in the United States have grown more rapidly. At their peak before the crisis, they were roughly twice as large as traditional bank liabilities. Currently, they are about 25 per cent larger. Since 2007, total MBF activity has remained relatively unchanged in Canada, while it has declined in the United States by approximately 25 per cent over the same period.

Chart 2 and **Chart 3** provide a breakdown of total MBF liabilities by component in Canada and the United States, before (2007) and after (2010) the crisis. In Canada, the repo market is the dominant component of the MBF sector, representing 55 per cent of total liabilities. In recent years, the securitization of mortgages has increased sharply, in particular, the issuance of NHA MBS (see **Box 1** for further details), which increased from about 5 per cent of outstanding residential mortgages in 1998 to almost 20 per cent in 2007 (Witmer 2010).[8] In the United States, repos, MBS and other ABS increased sharply until the crisis and have since fallen back. Gorton and Metrick (2010) tie the growth of the repo and ABS/MBS markets in the United States together, noting that the latter securities were often used as collateral in repo transactions.[9] This practice was different in the United States than in Canada, where most of the collateral used for repo transactions is composed of securities issued or guaranteed by government entities (**Chart 4**).[10]

5 It is important to note that the failures of individual institutions and markets that occurred during the recent financial crisis were not primarily due to a lack of public involvement in the MBF sector. Excessive risk-taking by market participants owing to a lack of understanding of the securitized products also played a part. Moral hazard was created through the mistaken belief that public authorities would intervene to prevent losses in MBF activities.

6 In Canada, DBRS rates securitized instruments, and the CMHC insures mortgages, including some that are subsequently securitized. See CMHC (2009) for further details. In the United States, the government-sponsored enterprises Freddie Mac and Fannie Mae facilitated the securitization of the bulk of conventional mortgages.

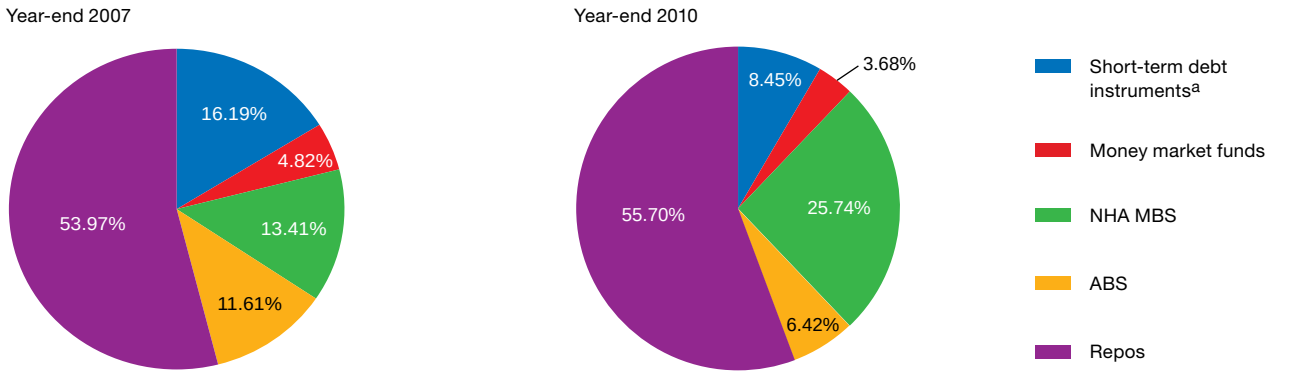
7 Note that using total liabilities to compare the size of MBF with that of the traditional banking sector is imperfect because of the potential for double counting. For example, a deposit put into an MMMF that is in turn used to buy commercial paper creates two MBF liabilities, whereas the same intermediation handled by a bank would result in the creation of only one liability. Double counting is also possible in the regulated banking sector, but is likely to be less prevalent.

8 This upward trend was the result of several factors: changes in the NHA MBS program (e.g., more flexible features); the creation of the Canada Mortgage Bond (CMB) program; increased investor demand for securitized products before the crisis; and the Government of Canada's Insured Mortgage Purchase Program, which was instituted during the crisis to purchase mortgages from Canadian financial institutions (Witmer 2010). More recently, covered bonds have been used by Canadian banks as another means of borrowing against their mortgage holdings.

9 Gorton and Metrick (2010) argue that the development of the repo market was also driven, in part, by regulation, in particular the lack of insurance on deposits greater than $100,000 and the bankruptcy treatment of repo contracts. Repos are essentially collateralized deposits that give the depositor the right to claim the collateral in the event of the bankruptcy of the borrowing institution. Other factors also contributed to the development of repo markets. In particular, securities dealers use repo transactions to facilitate their market-making activities, including financing inventories of securities and borrowing securities to sell to clients. Consequently, the existence of a repo market enhances liquidity and price discovery in secondary markets. Repos, however, increase leverage and can be used to boost expected returns, which may increase risk if, for example, long-term assets are financed with short-term repos that need to be rolled over frequently. Morrow (1995) provides an overview of the early development of Canadian repo markets.

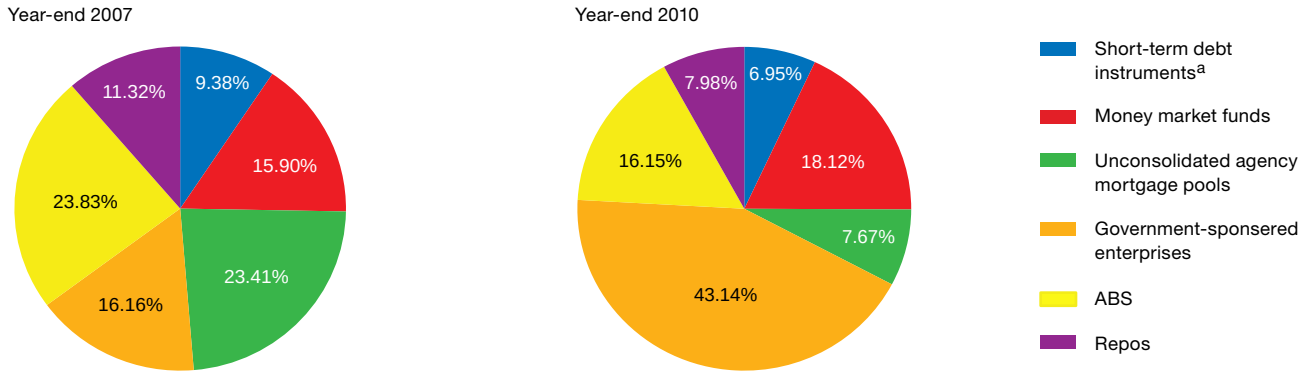
10 About 75 per cent of repo transactions in Canada use Government of Canada bonds and treasury bills as collateral. Of the remaining 25 per cent, most consist of federal or provincial government-guaranteed securities.

Chart 2: Canadian MBF, by component, before and after the crisis



a. Short-term debt instruments are the sum of commercial paper, ABCP and bankers' acceptances outstanding.
Source: Bank of Canada Last observation: 2007Q4 Last observation: 2010Q3

Chart 3: U.S. MBF, by component, before and after the crisis



a. Short-term debt instruments are the total outstanding amounts of open market paper.
Source: U.S. Federal Reserve Last observation: 2007Q4 Last observation: 2010Q4

While many regulated financial institutions, such as banks, insurance companies, pension and mutual funds, as well as provincially regulated credit unions, participate in MBF activities, other institutions that lie outside the perimeter of regulation are also active. These include hedge funds, which may be buyers of ABS and users of repo financing, and finance and leasing companies, which issue ABS to finance various pools of loans. A notable characteristic of this sector in Canada, compared with the U.S. sector, is the greater participation by regulated financial institutions. For example, virtually all of the participants in the NHA MBS market are either federally or provincially regulated. Similarly, the dominant participants in the repo market are banks and regulated securities dealers.

Comparing the MBF sectors in Canada and the United States is instructive for understanding the vulnerabilities of the Canadian sector and the related systemic risks (discussed in the next section), and also for considering possible regulatory reforms. In Canada, the dominant and active participation of the major regulated financial institutions in MBF activities and the widespread use of government or government-guaranteed securities as collateral to underpin these transactions render the Canadian MBF sector less vulnerable. Nonetheless, because of the dynamism and heterogeneity of the sector, it merits close monitoring to understand its possible impact on systemic risk.

Key Vulnerabilities in MBF Exposed by the Crisis

As discussed above, MBF is essentially a market-based alternative to the traditional financial intermediation processes that take place within a typical bank. Consequently, MBF activities are subject to the same vulnerabilities as traditional bank intermediation, but they do not receive the same degree of prudential oversight, nor do they typically have the same access to publicly provided liquidity facilities. These potential systemic vulnerabilities are both cross-sectional and procyclical, and are exacerbated by

Box 1

National Housing Act Mortgage-Backed Securities

A major type of securitization used in Canada consists of mortgage-backed securities (MBS) that are guaranteed by the Canada Mortgage and Housing Corporation (CMHC) under the authority of the National Housing Act (NHA). This type of security is known as an NHA MBS. Under the NHA, the securities issued or guaranteed by CMHC are fully backed by the Government of Canada.

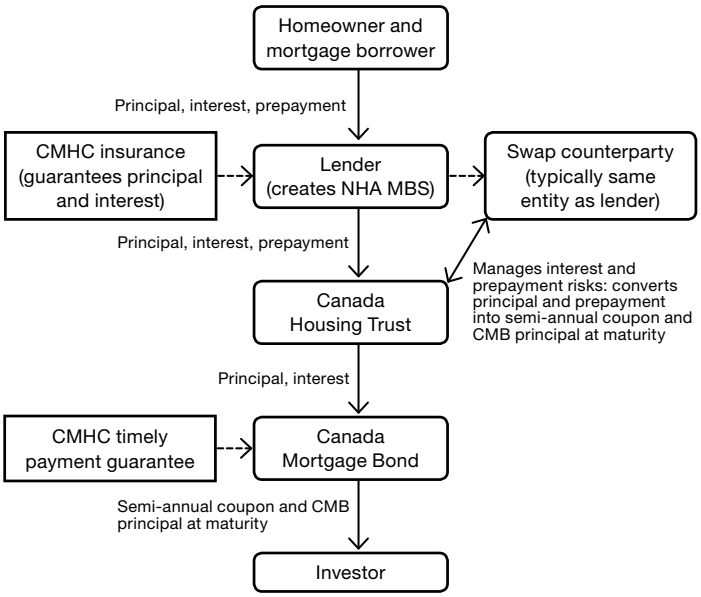
A financial entity that would like to participate in issuing NHA MBS must meet minimum criteria set out by CMHC. These criteria include a net worth requirement and a minimum level of financial performance.

To issue NHA MBS, a participant in this program (e.g., a chartered bank) creates a pool of insured mortgages that it has originated subject to a set of government-approved underwriting standards that are of consistent quality. The pool is then guaranteed, for a fee, by CMHC; this guarantee covers the principal and interest on securities issued in the pool. The pool of mortgages is placed with a trust, and securities are issued against the cash inflows from the mortgages. Investors in these securities are not subject to credit risk, owing to the CMHC timely payment guarantee as well as the CMHC insurance on the underlying mortgages. The NHA MBS may be subsequently sold to the Canada Mortgage Bond (CMB) program, in which case the Canada Housing Trust issues non-amortizing, semi-annual coupon bonds backed by the mortgage pools and fully guaranteed by CMHC and the Government of Canada. The interest rate and prepayment risks inherent in the underlying mortgages are managed via a swap transaction and investments in permitted securities. The broad outline of this process is shown in **Figure 1**.

In addition to the federal government guarantee and the interest rate and prepayment risk hedges described above, the NHA MBS program includes many other mechanisms to mitigate credit risk. A detailed description of the NHA MBS program can be found in CMHC (2006).

The NHA MBS program started in 1987 and, in 2001, was enhanced by the CMB program, which significantly increased the outstanding volume and secondary market liquidity of securitized mortgages.

Figure 1: The NHA MBS securitization process



While NHA MBS and CMBs have identical credit risk as securities issued by the Government of Canada, the liquidity risk is not the same, especially during periods of severe market stress. This greater liquidity risk, which is not unique to those securities, is evidenced by the spread between CMBs and equivalent Government of Canada bonds, which reached nearly 90 basis points during the crisis, compared with approximately 15 basis points before the crisis and the current level of about 25 basis points.

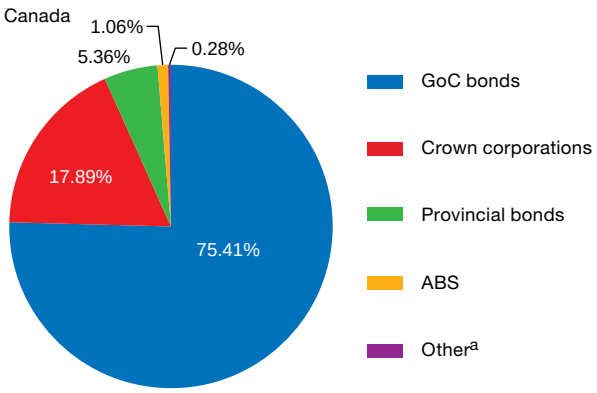
the linkages between the MBF and traditional banking sectors.

While the Canadian MBF sector escaped the worst of the global financial crisis, the disappearance of the non-bank-sponsored ABCP market illustrated some of the latent vulnerabilities of MBF, which are examined in more detail below. The ABCP market collapsed because of the high degree of leverage embedded in these structured instruments, which were backed by troubled offshore assets and had inadequate arrangements for liquidity support.

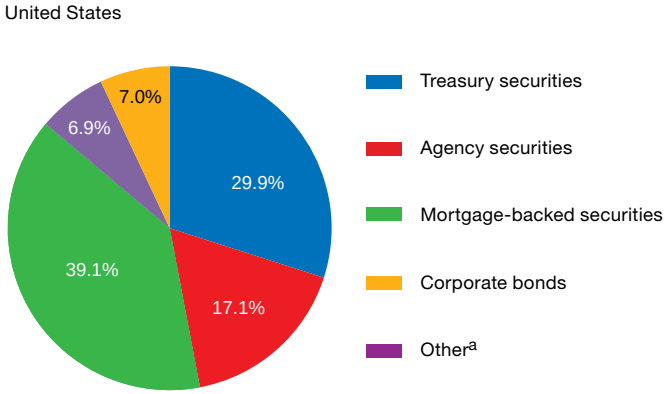
Panics and liquidity crises

The first cross-sectional vulnerability that might arise in the MBF sector is exposure to panics. Owing to their funding structure, entities that rely on MBF are susceptible to liquidity crises that resemble a classic bank run. In MBF, longer-term lending is financed by short-term funding, which is usually provided by commercial and institutional

Chart 4: Typical components of repo market collateral



a. Other securities include corporate, municipal, and bank trust mortgage company paper.
Source: Bank of Canada Last observation: 2010Q3



a. Other securities include equities, asset-backed securities, money market instruments, ETFs, CDOs, and municipal debt.
Source: U.S. Federal Reserve Last observation: 9 April 2010

investors.[11] This intermediation takes place outside traditional bank channels by, for example, the sale of short-term assets such as commercial paper or ABCP. An entity may also fund the purchase of an asset by using that asset as collateral in a repo agreement. In the Canadian case, in addition to repos, wholesale funding most often consists of wholesale deposits and short-term debt securities (such as bearer deposit notes, commercial paper or bankers' acceptances). Because of the maturity mismatch between the funds loaned and received, borrowers are vulnerable to runs, since they invest in assets that may not be easily sold if lenders simultaneously refuse to roll over their short-term funding.

The non-bank Canadian ABCP conduits that were affected during 2007 provide a prime example of how a liquidity crisis can unfold with MBF. In that case, maturing instruments were not rolled over into new issues as investors became more aware of, and concerned about, the potential risks. This rollover risk is similar to the risk of bank runs in traditional banking, with the important difference that MBF lenders do not benefit from deposit insurance, and MBF borrowers typically do not have direct access to central bank liquidity.

Interconnectedness and counterparty credit risk

A second vulnerability in MBF is counterparty credit risk arising from the interconnected nature of the MBF sector. MBF investors are exposed to credit risk, both from their direct counterparty and, more generally, in the form of a network externality.[12] While the former risk is generally well understood, the latter is unlike the risk faced by a depositor in a traditional bank.[13]

The network externality in MBF is exacerbated by the replacement of internal bank processes with market-based alternatives, which creates a network of obligations and flows that require an investor to both be aware of the creditworthiness of its direct counterparty and to understand how the counterparty is connected to the rest of the financial system. Caballero and Simsek (2009) define this vulnerability as a "complexity-externality." In normal times, this network functions efficiently to transfer funds and risks between participants. During a crisis, however, each participant in the system can be exposed not only to the risk of its own counterparties, but also to that of their counterparties' counterparties, and so on. This complex network of interconnected obligations may become too difficult to comprehend, and the resulting uncertainty may cause or amplify a financial panic. With reference to the non-bank ABCP example used above, investors became concerned not only about their own exposures to the troubled assets, but about their counterparties' exposures as well.

Securitization: Opacity and illiquidity

To mitigate the different types of counterparty risk, MBF is often conducted on a secured basis against high-grade collateral. This could lead to a third cross-sectional vulnerability that is related to the opacity and illiquidity of some of the securitized assets being used as collateral

11 An important category of large investors consists of MMMFs, which manage the liquid assets of corporate clients, as well as individual investors. See Kacperczyk and Schnabl (2010) for more details on MMMFs and the commercial paper market in the United States.

12 This exposure to counterparty credit risk manifests itself in two ways: directly, through the default of a counterparty if the exposure is not fully collateralized; and indirectly, through an exposure to market risk and liquidity risk if the exposure is collateralized.

13 Gregory (2010) provides a complete treatment of traditional counterparty credit risk.

in secured borrowing.[14] This opacity—which has become less prevalent since the crisis—led lenders and investors to place a greater emphasis on the ratings provided by CRAs.

One way to acquire high-grade collateral of the type commonly used in some countries before the crisis was to use securitization to transform illiquid assets into highly rated, more-liquid tradable securities. This type of collateral created a vulnerability, however, because, during the crisis, it suddenly became illiquid and difficult to value. This opacity exacerbated the U.S. subprime-mortgage problem because not only were the original subprime mortgages securitized, additional securitization was applied to the resulting tranches until it was extremely difficult, if not impossible, to accurately assess the exposures to default in various adverse scenarios. A similar problem plagued Canadian non-bank ABCP in 2007, which in some cases was backed by other structured assets, such as collateralized debt obligations (CDOs). The lack of information that results from such layers of securitization can amplify a liquidity crisis, because the value of these assets becomes extremely sensitive to new information, which in turn makes them less suitable for use as collateral (Gorton 2010).

Owing to its lower degree of regulation, the MBF sector is often the area of the financial system where financial innovations are first developed and marketed. These financial innovations create new ways to transfer and hedge risk, which provide a benefit for the economy as a whole, but can also lead to risks that may not be well understood, owing to their opacity or novelty (as in the case of CDOs or exchange-traded funds). In addition, opaque structures can be used to hide leverage off the balance sheet and away from investors and prudential and systemic regulators. This may be done for regulatory arbitrage purposes in order to reduce the amount of capital a financial intermediary must hold. Furthermore, the risk transfer that these innovations are designed for is incomplete.

Procyclicality in leverage: Systemic concerns

While the MBF system has evolved to protect individual participants from the idiosyncratic risk of their counterparties, the system as a whole is vulnerable to systemic shocks. Procyclical vulnerabilities also serve as channels to transmit systemic shocks through the MBF sector.

The primary procyclical vulnerability is the buildup of leverage that is permitted by MBF activities, owing to their lower level of regulation. The link between the leverage that can be obtained through collateralized market-based transactions and the haircut charged in collateralized lending is an example of this procyclicality (Kamhi 2009). While a haircut protects the lender against market volatility, it also directly influences the amount of leverage a borrower receives in a transaction. Since haircuts tend to vary with the business cycle, leverage in collateralized borrowing can be highly procyclical, potentially acting as a destabilizing force for the financial system as a whole (CGFS 2010). More broadly, changes in the constraints on funding liquidity faced by financial intermediaries (which include haircuts) can have a first-order impact on asset prices and market dynamics, and thus propagate and amplify financial shocks throughout the financial system (Fontaine and Garcia 2009).

The systemic vulnerabilities of MBF in Canada are currently relatively low, for at least two reasons: the reduction in unregulated MBF activity following the non-bank ABCP crisis, and the fact that, in Canada, MBF is generally concentrated among the well-regulated and supervised chartered banks. In addition, microprudential and system-wide regulatory work under way domestically and internationally will further reduce vulnerabilities inherent in the MBF sector. Nonetheless, the high degree of innovation in this sector necessitates that it be monitored continuously, using a systematic approach to identify emerging vulnerabilities.

Possible Reforms of MBF

MBF has intrinsic vulnerabilities that can increase systemic risk by fostering the development of less stable practices in financial markets, facilitating regulatory arbitrage or changing the incentives of the regulated sector. It can also lead to common exposures and interconnections among institutions, amplifying shocks and exacerbating procyclicality. But this sector also serves useful and legitimate economic functions: it contributes to the efficient funding and transfer of credit risk; it can provide competition to the traditional banking sector (more so in countries where banks are not also the primary entities active in MBF activities); and it diversifies credit sources available in the economy. If properly constrained, MBF can thus lead to welfare-enhancing financial innovation. Hence, the regulatory approach should be balanced and should aim to mitigate the sector's risks and vulnerabilities while preserving its benefits. The regulatory approach will also need to evolve gradually, recognizing that increased regulation of banks may create incentives for more activities to move to the MBF sector, as well as the potential for new instruments and activities to emerge, and the modification of existing ones in ways that increase systemic risk.

There are four broad ways to address concerns that MBF could pose risks to the stability of the financial system (FSB 2011a). The first is to make the prudentially regulated entities that interact with the MBF sector, such as banks, more resilient by encouraging them to better manage the risks related to MBF activities and by requiring them to hold sufficient capital and liquidity, thus reducing the potential for contagion from MBF to the overall financial system. Steps can also be taken to reduce opportunities

14 Kirabaeva (2010–11) examines the adverse effects of a lack of information on financial stability in the context of the recent financial crisis.

for regulatory arbitrage. The second is to broaden, increase or improve the regulation of entities active in, or facilitating, MBF activities, such as hedge funds, MMMFs and CRAs. The third is to monitor MBF activities and either regulate them or foster best practices; for example, with regard to securitization. Finally, the risks posed by MBF may be addressed through macroprudential measures and improvements to the infrastructures that support markets. Some of the reforms that are under way or have been proposed internationally and in Canada are described below.

Reducing the risk of contagion from MBF activities

Basel III introduces a number of changes that will reduce the prospect for contagion between the MBF sector and the regulated banking system. First, banks will be required to hold more and better-quality capital, which will help them to withstand shocks. Second, new liquidity standards will be introduced to foster prudent practices for funding and liquidity management. All else being equal, these standards will decrease the reliance on short-term funding (such as overnight repos) and the demand for illiquid assets (such as securitized products), both of which contributed to the growth of MBF and the buildup of vulnerabilities before the crisis. These new standards will also make it more costly for banks to provide backup liquidity lines to ABCP conduits and special-purpose vehicles. Third, a new limit on leverage similar to the one that exists in Canada will be introduced as a backstop against excess risk exposure that can sometimes arise with risk-based capital rules.[15] Combined with changes that will make it more difficult for banks to move assets off balance sheet, this should help to reduce the scope for MBF to expand because of regulatory arbitrage.

Although these changes will enhance the overall resilience of the financial system, they may encourage more risk-taking and cause activities to move to the unregulated MBF sector, so other measures are needed.

Enhancing the monitoring and regulation of entities active in MBF

Initiatives are also being taken to improve the monitoring, and to enhance the regulation, of entities that participate in MBF, such as hedge funds, MMMFs and CRAs.

Hedge funds

In the case of hedge funds, members of the International Organization of Securities Commissions (IOSCO) agreed to a common template for the global collection of hedge fund information to help regulators in the assessment of systemic risks and to inform any planned legislative changes.[16] In addition, the IOSCO task force recommended that a global data-gathering exercise based on this template be carried out in September 2010 to the best ability of each jurisdiction (pending legislative changes). The Canadian Securities Administrators (CSA) participated in the exercise.[17] In the United States, the Dodd-Frank Act will require that hedge fund advisers with over $150 million in assets under management register with the Securities and Exchange Commission (SEC) and provide extensive records about their investment and business practices. In Canada, the CSA introduced a mandatory registration regime for investment fund managers, which is expected to be in full force by September 2011.[18] Similar steps are being taken in other countries.

Money market mutual funds

Reforms have also been proposed for MMMFs. As explained earlier, MMMFs can be susceptible to a sudden loss of confidence and destabilizing runs by investors. The industry has had a long-standing practice of maintaining a stable net asset value despite the absence of government insurance or access to public sector liquidity, while allowing investors to withdraw funds on demand. This creates a mismatch between the maturity and liquidity of the funds' investments and those of their liabilities, which the proposed reforms aim to address. In order for these funds to be better able to handle redemption requests, both the SEC in the United States and securities commissions in Canada have enacted tougher requirements that shorten the average term to maturity of the investment portfolios of MMMFs and require them to maintain higher minimum levels of highly liquid assets.

There is, however, a tension between these requirements and the requirements under Basel III for banks to lengthen the duration of their funding, given that MMMFs are an important source of funding for some banks, particularly in Europe. And while the steps taken to improve the ability of MMMFs to handle redemptions are helpful, more of them are needed to reduce the vulnerability of this sector.

15 The regulatory measure of leverage in Canada is the ratio of total assets and certain off-balance-sheet items to total regulatory capital. The limit for this multiple is 20, but banks in good standing can be allowed to increase it up to 23 if they meet certain conditions. See OSFI (2007) and Bordeleau, Crawford and Graham (2009).

16 Member jurisdictions that agreed to this template include, among others, Canada, the United Kingdom and the United States.

17 While results from this data-gathering exercise are not public, the Canadian hedge fund industry is estimated to be a fraction of the size of both the Canadian mutual funds industry and the global hedge fund industry.

18 Requirements under National Instrument 31-103 cover capital, financial reporting, compliance, conflict of interest and outsourcing.

Credit-rating agencies

CRAs play a key role in MBF activities by aggregating and disseminating information about different securities in the form of credit ratings. In the years preceding the crisis, the high ratings assigned to securitized products were central to the confidence placed by investors in these instruments and enabled firms to use them to obtain short-term market-based funding (see the previous section). The subsequent downgrades in the ratings raised concerns about the reliability of the CRA rating process, the CRAs' inherent conflicts of interest[19] and the lack of formal regulation of CRAs (Zelmer 2007). Regulatory initiatives in the United States, Europe, Canada and elsewhere seek to remedy the lack of formal oversight of CRAs and to alleviate the conflict of interest inherent in the issuer-pays model.

Efforts are also under way to reduce the widespread and often mechanistic reliance on CRA ratings for regulatory and investment decisions.[20] This should lower the risk of a renewed growth in MBF driven by the creation of securitized products.[21]

Fostering best practices in MBF activities

Steps are also being taken to restore confidence and improve the resilience of securitization markets. One important initiative has been to encourage greater transparency among issuers of securitized products. IOSCO published disclosure principles for ABS, and the Financial Stability Forum (FSF) recommended that financial institutions with significant exposures to structured credit products provide additional risk disclosures, and identified leading practices in this regard (FSF 2008). Regulators and institutions in various jurisdictions have either taken steps to implement those recommendations or are working on how best to do so in their respective markets.[22] In Canada, the CSA proposed a framework for regulating securitized products that would improve investor protection through enhanced transparency and disclosure requirements, both at the time of distribution and on an ongoing basis.[23]

Macroprudential measures and improvements to market infrastructures

Macroprudential measures and improvements to market infrastructures can also help mitigate the risks of instability stemming from MBF. These measures can include ways to alleviate procyclicality in the financial system by, for example, using margins and haircut policies that are less procyclical (CGFS 2010). Additional measures can include improvements to the infrastructures supporting markets, such as a greater use of properly risk-proofed central counterparties for repo and derivatives transactions (see Chande, Labelle and Tuer 2010: Slive, Wilkins and Witmer 2011). These steps should reduce the risk of contagion across the financial system.

Conclusion

The rapid expansion in the magnitude and scope of MBF activities in Canada and the rest of the world over the past 15 years makes it imperative to understand the reasons for this dynamic growth and the potential vulnerabilities that may accompany it. The expansion, which largely reflects competitive market forces and ongoing financial market deepening, is increasing the overall efficiency and resilience of financial intermediation activities. However, the high rate of financial innovation and the constantly evolving activities are raising concerns that some of this innovation may be driven by regulatory arbitrage, outpacing public oversight and increasing systemic risk. A more systematic approach to monitoring these activities and further research are required to identify and assess the impact on systemic risk of any vulnerabilities emerging from the MBF sector, and to determine whether the intensity or perimeter of regulation and supervision of MBF should be reformed. An appropriate balance should be struck between the benefits of this innovation and its impact on systemic risk.

The recent financial crisis exposed significant weaknesses in MBF activities, in particular, the lack of transparency and the excessive buildup of leverage. Reforms are under way at national and international levels to address these shortcomings. The MBF sector has proven to be relatively resilient in Canada because of the dominant participation of prudentially regulated institutions and the widespread use of government collateral. Nonetheless, an important lesson from the non-bank ABCP crisis and the financial crisis more generally is that the Canadian financial system is not immune to potential vulnerabilities in the MBF sector, whether homegrown or arising in other countries and transmitted to Canada through the globalization of markets and institutions. Thus, a coordinated global response is needed to establish clear principles for the monitoring, assessment and regulation of MBF that allows for differences in the MBF sector across countries and limits unintended consequences and opportunities for cross-country regulatory arbitrage.

19 Most CRAs use an "issuer-pays" model where the issuer of the security pays the CRA to issue a rating. This raises concerns about conflicts of interest and ratings shopping (Bolton, Freixas and Shapiro 2009).

20 See FSB (2010) and SEC at <http://www.sec.gov/news/press/2011/2011-59.htm>.

21 Mandatory risk-retention requirements have also been proposed in some countries to better align the interests of the sponsors of securitized products with those of investors. Of course, implementation details will be just as important as the principle behind this initiative for it to have the desired effects.

22 The FSB assessed the implementation of these recommendations by its 24 member jurisdictions and the major financial institutions located in those jurisdictions (FSB 2011b).

23 The proposed regulation also modifies the current exemptions that investors use to access these products in the exempt market.

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Access to Central Clearing Services for Over-the-Counter Derivatives

Joshua Slive, Carolyn Wilkins and Jonathan Witmer

Introduction

The recent financial crisis revealed several weaknesses in the global financial system, one of the most important being the high degree of interconnectedness among market participants and a lack of transparency regarding the associated counterparty exposures. The failure of Lehman Brothers in 2008, for example, caused shocks to cascade through the market for credit default swaps, severely disrupting that market and placing many other financial institutions at risk. In contrast, markets that were backed by a sound central clearing infrastructure to help mitigate and manage counterparty risk performed much better through the crisis. Exchange-traded products and interest rate swaps, for example, were less disrupted by the Lehman default.[1]

In this context, the G-20 committed to reduce risks to the global financial system by having all standardized over-the-counter (OTC) derivatives contracts cleared by central counterparties (CCPs) by the end of 2012. The use of CCPs with proper risk-management controls reduces systemic risk by centralizing counterparty risk—thereby making its management more uniform and transparent—and by lowering system-wide exposures to counterparty risk through multilateral netting and risk mutualization. As a result, greater use of CCPs should reduce uncertainty regarding exposures and the likelihood that a default will propagate across the network of major market participants.[2]

Broad access to central clearing will be necessary to fully realize the expected benefits of systemic-risk reduction from the increased use of CCPs. The evolving configuration of access to CCPs may, however, have unintended consequences for the structure of the global OTC derivatives market. As the use of CCPs is mandated or strongly encouraged and thus becomes widespread, access requirements could have important implications for market innovation, concentration, competition and the resilience of local financial markets. For example, requirements that limit access based on size considerations could help to perpetuate and expand the dominance of very large dealers. They could also reduce the ability of local markets to withstand financial shocks. The importance of achieving fair and open access to CCPs has been recognized by the Financial Stability Board (FSB) Working Group on OTC Derivatives (FSB 2010), as well as other international groups.[3] According to CPSS-IOSCO (2011),

> Fair and open access to [financial market infrastructure] services encourages competition among market participants and promotes efficient and low-cost clearing and settlement. . . . participation requirements should therefore encourage broad access, including access by participants, other market infrastructures, and where relevant service providers, in all relevant jurisdictions, based on reasonable risk-related participation requirements.

Access to CCPs is of particular concern to countries like Canada that are not home to the important global CCPs.[4] Unlike some of these countries, Canada has large dealers

1 The contagion channels between dealers are explained in Duffie (2010a). Norman (2011), Monnet (2010) and CCP12 (2009) discuss how central counterparties helped protect some markets during the Lehman default.

2 A thorough account of the benefits of CCPs is provided in FSB (2010); Brunnermeier (2009); Duffie, Li and Lubke (2010); Kiff et al. (2010); and Chande, Labelle and Tuer (2010).

3 Among them are the Committee on the Global Financial System (CGFS), the Committee on Payment and Settlement Systems (CPSS), the International Organization of Securities Commissions (IOSCO) and the OTC Derivatives Regulators Forum (ODRF).

4 For an overview of reforms undertaken in OTC derivatives markets in Canada, see Wilkins and Woodman (2010).

that can access global CCPs, and many products of importance to the Canadian market are already cleared through global CCPs. But global CCPs may not provide a level playing field to Canadian dealers that are smaller than the global dealers and that face additional challenges from cross-jurisdictional access to clearing. In addition, offshore clearing may not provide the public sector with sufficient scope for oversight or control to mitigate and manage the effects of a financial crisis.

This report describes the challenges of achieving fair and open access to CCP services for OTC derivatives, as well as the potential effects of limited access for the resilience of financial markets and financial system stability. It then presents two strategies for addressing the consequences of restricted access to CCPs for systemic risk. The first strategy would require global CCPs to create access requirements that are proportional to risk. The second is to establish domestic CCPs that are appropriately aligned to market conditions and risks in different jurisdictions. Commensurate with these initiatives is a need to develop principles and a framework for co-operation in oversight arrangements, as well as for liquidity provision and failure resolution for CCPs.

Access Challenges at Global CCPs

A market participant can clear transactions at a CCP in one of two ways: either by becoming a direct clearing member of the CCP, or by clearing indirectly, as a client of a direct clearing member. Each method poses potential challenges for mid-tier financial institutions or for those that are not based in the CCP's home jurisdiction.[5]

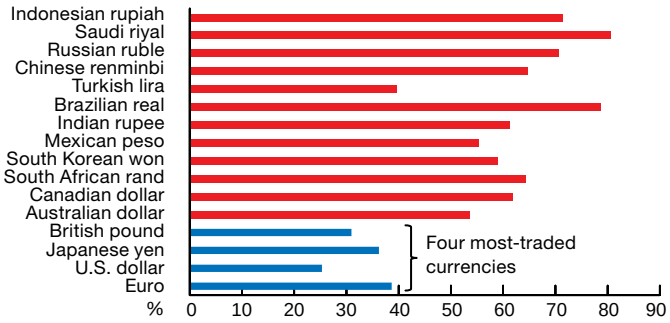
Active participants in OTC derivatives markets may be unable to obtain cost-effective direct membership in global CCPs as currently structured

Currently, the criteria for direct membership in existing global CCPs for OTC derivatives are based principally on the size of the institution, as well as the volume and breadth of its OTC derivatives activities. These criteria can result in the exclusion of mid-tier global institutions (because they do not meet size requirements) and institutions that specialize in particular products, geographic areas or client types (because they cannot participate in default management for market segments where they have no expertise), even though these institutions may be of extremely high quality and pose very low risk to the CCP and other clearing members.[6]

Smaller jurisdictions are particularly affected, since they tend to have mid-sized and smaller firms dealing heavily in derivatives denominated in the local currency. **Chart 1** shows that market participants who are not among the largest 14 derivatives dealers (the G14) are very active in interest rate swaps (IRS) outside the four most-traded currencies.[7] For Canadian-dollar IRS, over 60 per cent of G14 dealers' transactions involve non-G14 counterparties.[8] Moreover, 55 per cent of OTC transactions in Canadian IRS involve a Canadian bank on at least one side of the transaction (**Chart 2**).

Chart 1: Excluding the four most-traded currencies, the majority of IRS trades include participation from non-G14 dealers

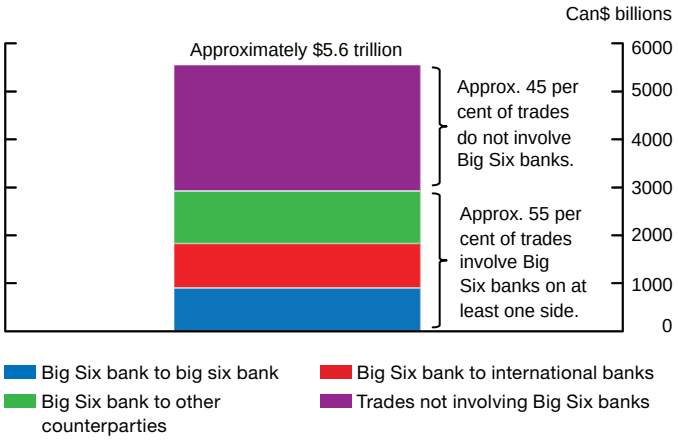
Share of the notional amount outstanding of G14 dealers' transactions with non-G14 counterparties



Note: Currencies are ordered on the *y*-axis from the smallest to the largest notional amounts outstanding of OTC derivatives.
Source: TriOptima Last observation: 25 February 2011

Chart 2: The Big Six banks participate in more than half of Canadian-dollar IRS trades

Can$-denominated IRS notionals



Sources: Canadian Market Infrastructure Committee (October 2010) and BIS Triennial Survey (June 2010) Last observation: 31 October 2010

5 While CCPs exist in many countries, the dominant CCPs for OTC derivatives are currently based in the United States (ICE Trust, CME) and the United Kingdom (LCH.Clearnet SwapClear, ICE Clear Europe).

6 A recent proposal by the United States Commodity Futures Trading Commission would restrict the minimum capital requirement to $50 million or lower and prevent CCPs from excluding non-dealers as members.

7 The G14 consists of Bank of America Merrill Lynch, Barclays Capital, BNP Paribas, Citigroup, Credit Suisse, Deutsche Bank, Goldman Sachs, HSBC, J.P. Morgan, Morgan Stanley, Royal Bank of Scotland, Société Générale, UBS and Wells Fargo.

8 We thank Mark Chambers of the Reserve Bank of Australia for suggesting that we look at these data.

Several of the largest Canadian banks qualify to be direct members of LCH.Clearnet's SwapClear, and some are already members.[9] But even where Canadian banks are able to become direct clearers at a global CCP, the fee structures may put them at a competitive disadvantage. Existing CCPs for OTC derivatives sometimes offer important volume discounts or put ceilings on fees, in effect charging proportionally lower fees to larger clearers. In some cases, volume discounts may be an appropriate response to the cost structure of the CCP. But fees that are designed to cover risks that are proportional to clearing activity should also be proportional; for example, placing a ceiling on contributions to a default fund allows larger clearers to take on more risk without fully paying their way.

In addition to the access issues described above, there are several challenges associated with cross-jurisdictional access to central clearing. CCPs may impose additional haircuts on offshore collateral and charge an extra initial margin to control for the liquidity risk of smaller currencies.[10] While this may be justified from a risk-management perspective, it could result in additional costs and risks for Canadian market participants using offshore CCPs, which could hinder the liquidity of Canadian financial markets. Offshore clearing could also create challenges for the public sector in establishing adequate oversight and in configuring emergency liquidity and resolution procedures.

Indirect access may not be the preferred solution for mid-tier market participants

As with most clearing and settlement systems, indirect clearing is an option for institutions that do not qualify as direct clearing members. Smaller institutions may prefer indirect clearing, since they can avoid the large fixed costs associated with direct membership, including operational costs and contributions to a default fund. (They will still pay a proportional share of these costs through clearing fees imposed by their direct clearers.)[11] But indirect clearers of OTC derivatives may face additional costs that could put them at a competitive disadvantage relative to direct clearers:

- *Higher capital charges:* Transactions cleared directly with CCPs that meet CPSS-IOSCO standards will face lower regulatory capital charges than bilateral trades. Indirect clearers will get the same low charges only under certain conditions.[12] If they are unable to meet these conditions, indirect clearers will not obtain this capital relief, although they will avoid capital charges on default-fund contributions.
- *Higher demands for posting margin/collateral:* The requirements for posting margins for indirect clearers are set by their direct clearing members and are typically higher than the margins charged by the CCP for direct clearing. The additional margin charges are necessary to mitigate the increased risks associated with indirect clearing.
- *Exposure to the market power of the direct clearer:* A direct clearer controls its fees and margins to protect itself from the default risk of its indirect clearers; it could use this power to gain a competitive advantage over an indirect clearer that is also a competitor.[13] Indirect clearers may also perceive a risk that their direct clearer, who might be their competitor, could benefit from access to information on their clearing flow, despite internal measures (e.g., governance) to reduce the risk of this happening. The degree of market power depends on how much competition exists between direct clearers for indirect business and how easy it is for an indirect clearer to switch to another direct clearer.

Consequences of Limited Access

The existence of global systemically important financial institutions may be reinforced by limited access to CCPs

The G-20 reform agenda for OTC derivatives can potentially reduce the dominance of very large market participants by promoting standardization, transparency and electronic trading. Broader use of CCPs could further level the playing field in OTC derivatives, because CCPs reduce the need to monitor the default risk of each counterparty. But mandating central clearing in a setting where cost-effective direct access to CCPs is limited to the largest dealers may transform a market that was tiered for economic reasons into one where tiering is reinforced by the structure of international regulation and market infrastructure.[14] This new market structure may reflect,

9 SwapClear is the current market leader in IRS and clears swaps in 14 currencies, including Canadian-dollar swaps out to 30 years.

10 There are also legal risks associated with uncertainty over the finality and irrevocability of payments, bankruptcy resolution and rights over collateral, given the possibility of conflicting laws across jurisdictions.

11 Chapman, Chiu and Molico (2008) show that small players might not want to pay the direct participant costs, and may be extended only limited credit by other participants in the settlement system, since they do not have sufficient reputation to join.

12 The rules proposed by the Basel Committee on Banking Supervision will extend reduced capital charges to an indirect clearer if "(i) any assets of the non-member bank related to such trade are segregated and bankruptcy remote from the clearing member; and (ii) the non-member bank is legally ensured that another CCP member will take over such trade if the original clearing member counterparty cannot perform" (BCBS 2010). Current indirect clearing set-ups do not meet the second requirement.

13 Lai, Chande and O'Connor (2006), for example, construct a model to examine a direct clearing member's incentives to gain a competitive advantage over its indirect clearers in the market for retail payment services.

14 Harris (2006) discusses the unintended consequences on competition of regulation in the futures market.

in part, the considerable influence wielded by the largest global dealers over the rules of CCPs for OTC derivatives through ownership, control of the risk committee and their market power in the purchase of CCP services.[15]

While the move to central clearing will reduce the interconnectedness of global systemically important financial institutions (G-SIFIs), their systemic importance could increase in a system that has limited access to CCPs, with significant unintended consequences:

- *A CCP that has only G-SIFI members as participants may be less able to handle a major systemic shock than a CCP that has a wide and diversified membership*. Mid-tier institutions with expertise in certain market segments could provide valuable risk- and default-management capacity without needing to participate in all segments of default management (Duffie 2010b).
- *G-SIFIs may gain market shares in other business lines if they have preferential access to CCPs*. This is because a lower cost of clearing OTC derivatives transactions may yield advantages in other business lines, such as bond underwriting and structured finance. These advantages could translate into advantages in the market for customized, bilaterally cleared derivatives, as well as other markets. For example, OTC derivatives are frequently used to hedge positions in bond markets, minimize funding costs using IRS and protect a loan portfolio using credit default swaps.
- *Reduced contestability of markets may weaken market resilience*. If there are fewer direct participants, the failure of any of them will be more important in terms of its impact on market liquidity. This could undermine the resilience of the market and increase the opportunity for systemic shocks to propagate. If mandated clearing under current access models reinforces the market dominance of G-SIFIs more generally, the risk that shocks to a single institution will have widespread effects on markets will be increased.

Mid-tier institutions may become more vulnerable in times of stress

Relative to global dealers, some Canadian institutions may face increased costs as indirect clearers, while the largest Canadian dealers may face additional costs as direct clearers. Although these costs may be small in normal times, margin requirements can increase dramatically in periods of stress, and the costs of supplying collateral may simultaneously climb. Market participants that depend on others for clearing services may find those services more difficult to obtain, decreasing liquidity and potentially contributing to increased procyclicality (CGFS 2010). Clearing members are likely to tighten their requirements for client clearing and may also favour firms with which they have broader and more direct relationships.[16]

High costs of clearing may discourage central clearing and reduce activity in standardized OTC derivatives

Costs of clearing services in the form of direct costs or collateral requirements that are too high can have two adverse effects.[17] They may encourage market participants to retain bilateral clearing practices, where feasible, possibly through greater use of non-standardized products that are not eligible for central clearing. If bilateral clearing is not possible, high clearing costs can reduce the use of OTC derivatives. While it may be appropriate to limit the use of derivatives to the extent that systemic risk in the market is not adequately controlled, restricted use of OTC derivatives can also reduce risk hedging, which can expose firms and the economy to more risk.

Elements of an Effective Solution

An effective strategy to mitigate the risk of unintended consequences arising from restricted access to CCPs must also include strong risk controls for CCPs, give financial authorities the tools to manage extreme shocks, and support a robust and efficient market in OTC derivatives.

One element of the solution is to improve direct access by recognizing the ability of high-quality mid-tier market participants to safely participate in direct clearing in proportion to their risk characteristics. A second element could be to manage risks in local markets using local CCPs.

Proportional access for mid-tier participants

To establish appropriate access conditions, it is important to develop access criteria that most effectively control risk at the CCP while protecting the stability and efficiency of the financial system. In place of measures of absolute size currently used by many CCPs, one strategy is to set access criteria and risk-management controls that are proportional to the risk profile of the clearing performed by each member.[18]

15 G14 dealers control the ownership of SwapClear (the dominant clearer of IRS) and the ICE risk committee (the dominant clearer of credit default swaps), and had substantial influence over the initial configuration of the CME Group's IRS clearing.

16 As the recent crisis demonstrated, at times of market stress, financial institutions tend to reduce client services, requiring them to take balance-sheet risk.

17 See Singh (2010) for a discussion of the potential collateral implications resulting from an increased central clearing of OTC derivatives.

18 CPSS-IOSCO (2011) suggests that "Where necessary, an FMI [financial market infrastructure such as a CCP] can establish less restrictive participation requirements in conjunction with appropriate risk-management controls. . . . Requirements should also reflect the risk profile of the activity; an FMI may have different categories of participation based on the type of activity. For example, a participant in the clearing services of a CCP may be subject to a different set of requirements than a participant in the auctioning process of the same CCP."

Membership criteria should be configured to enhance the CCP's ability to manage the default of one or more of its members. The criteria should aim to include institutions that can aid in managing defaults, and should exclude institutions that are more likely to default. By expanding membership to include high-quality medium-sized institutions, a CCP may increase the number of institutions that could bid for the failing member's positions, thereby increasing its total capacity for default management (Duffie 2010b).

Moreover, direct participation of local market participants whose credit is of high quality may be a source of strength for a CCP, particularly if they can offer market-making and pricing expertise in certain local products. For example, in the case of the default of a member with an important Canadian-dollar portfolio, Canadian institutions as direct clearers at the CCP may be best placed to manage the replacement of the portfolio and the liquidation of Canadian-dollar collateral. Canadian institutions would also be in a better position to monitor Canadian indirect clearers, since they would quite possibly already be monitoring the same clients in other areas of their business.

While it is beneficial to have a larger pool of members to aid in handling defaults, difficulties can arise when some members lack the operational capabilities to quickly price, buy and sell large defaulted portfolios in stressed market conditions. Although the increased use of electronic trading platforms should ease these difficulties somewhat, solving the difficulties may require modifications to a CCP's procedures for handling defaults. For example:

- Direct membership could be tiered to allow some members to play a less important role in the default process in exchange for larger default-fund or margin contributions.
- Parts of the default-management process (e.g., the responsibility to bid on the defaulting member's portfolio) could be partially or fully outsourced to sophisticated market participants.
- Default management could be partitioned to allow each clearing member to participate for the products in which it has the most expertise. If such partitioning is not possible in a global CCP, it could be accomplished by setting up local CCPs (see next section).

Each of these modifications entails its own set of risks. For example, outsourced default management may be less reliable in highly stressed situations, and partitioning may complicate and delay the process of hedging and replacing defaulted portfolios. It is important to determine the appropriate configuration of access criteria to ensure that the benefits of fair and open access outweigh the risks.

Local CCPs

Despite the existence of global CCPs for many OTC derivatives products, some jurisdictions have already responded to the G-20 commitments by creating local CCPs, or are seriously considering doing so.[19] In part, this is a response to the difficulty of reconfiguring access criteria for global CCPs. It is also consistent with related policy objectives that include simplified and direct oversight of systemically important financial infrastructure for local currency markets, as well as an ability to directly manage policies for liquidity provision and failure resolution. It may be possible to configure shared arrangements for oversight where officials from several jurisdictions co-operate to supervise a global CCP,[20] but a local CCP allows each jurisdiction direct control regarding regulation and oversight, as well as crisis management.

A stand-alone Canadian CCP may be able to protect Canadian markets from some global shocks, such as the default of a large offshore dealer or of an offshore CCP. While complete protection is not possible, owing to the many risk-propagation channels present in the global financial system, a decentralized structure for CCPs may reduce the risk inherent in concentrating the provision of market services in a small number of large entities.[21] There is, however, less effective risk mutualization and netting in a local CCP. With narrow participation, a Canadian CCP would have fewer resources to absorb the default of a participant and would need to impose higher costs on its participants to compensate. Attracting the broad participation of global dealers would mitigate some of the adverse effects of narrow participation.

Greater knowledge of Canadian market conditions may allow a local CCP to adapt its risk-management practices to the Canadian market, thereby achieving more open access without increasing risk. This may allow more Canadian market participants to gain low-cost access to clearing services, which could promote liquidity in Canadian financial markets. Better integration into Canadian financial markets may also allow a Canadian CCP to better configure netting across certain asset classes, reducing collateral demands for participants.

A Canadian CCP may, however, impose substantial increased costs on Canadian clearers and reduce market efficiency if it reduces access to foreign counterparties and multilateral netting opportunities. If Canadian market participants are forced to divide their derivatives portfolios among multiple CCPs, this will likely decrease their ability to net positions against each other. They will therefore

19 Singapore, Hong Kong, Poland, Brazil, India, Japan and China all plan to have domestic CCPs for OTC derivatives. Other countries are investigating this option. Only a few global CCPs currently have significant clearing volumes in OTC derivatives, so it is not yet apparent how successful the local CCPs will be.

20 For example, Canada and other jurisdictions share oversight of the CLS foreign exchange clearing system under the leadership of the Federal Reserve Bank of New York. Oversight of a CCP may, however, be substantially more complicated.

21 The Joint Regulatory Authorities of LCH.Clearnet Group (2008) also recognized the potential for multiple linked CCPs to decrease the risk arising from "a CCP being a single point of failure."

Box 1

Links Between CCPs and Cross-Margining Agreements

Linking arrangements, including peer-to-peer links and cross-margining agreements, are used by local CCPs to improve collateral efficiencies.

Peer-to-peer links allow two CCPs to connect as equals and to co-operate to clear trades where one counterparty clears through each CCP. Some harmonization of risk management and operational requirements is necessary to effectively manage risks associated with trades cleared across the link. Consistent with the proposed CPSS-IOSCO standards, the CCPs would have to hold additional financial resources to protect themselves from their exposures to each other.

Cross-margining agreements between CCPs allow for the joint margining of transactions in designated products. Common clearing members are thus able to net exposures with offsetting risk characteristics across CCPs for the purposes of calculating margin requirements.

Links introduce numerous legal and operational risks to the clearing system, especially as the number of links between CCPs increases. The CPSS-IOSCO principles will require that additional capital be available to mitigate the increased risks from links. This will make clearing over links more expensive, depending on the nature of the trades through such arrangements.

be forced to supply more margin collateral and may also choose to stop transacting in certain market segments or with certain counterparties. To improve collateral efficiencies, a local CCP could, over time, develop cross-margining or linking agreements with other CCPs (see **Box 1**).

From a global perspective, a model where local CCPs are linked to each other or to global CCPs provides a potential middle ground that could combine some of the advantages of local CCPs and global CCPs and permit broad access to the widest range of derivatives. In general, links provide a way of reducing collateral demands for a local CCP through increased netting efficiency, while still permitting some local control. In terms of the benefits of risk mutualization and protection (insulation) from global shocks, a linked system may be at least as resilient as a small set of global CCPs or a large number of stand-alone local CCPs.[22] But links also require that both the CCPs, as well as their respective regulators, agree on the terms and nature of the link. The arrangements will need to include appropriate risk controls to mitigate the additional risks that links introduce to the financial system, especially as the number of links between CCPs increases. At an international level, regulators are focused on links in cash markets. It is uncertain whether links will be a viable option for CCPs for OTC derivatives in the short term.

Conclusion

The G-20 countries, including Canada, have committed to increasing the central clearing of OTC derivatives transactions using CCPs in order to support financial stability; in particular, CCPs will reduce contagion arising from the interconnectedness of participants in OTC derivatives markets and enhance the transparency of exposures arising from derivatives trades. The CCP infrastructure should be configured in the best interests of Canadian financial markets and institutions. It should provide the most effective policy tools to constrain the spread of a financial crisis, reduce the effects of externally or internally generated systemic shocks on the Canadian market, and support the liquidity and efficiency of Canadian financial markets.

Considerable progress has already been made by international organizations such as the FSB, CPSS, IOSCO, CGFS and ODRF on issues related to OTC derivatives CCPs. This report suggests two strategies for addressing the potential unintended consequences of restricted access to CCPs:

CCPs could develop policies and membership requirements that are proportional to risk. This could expand access to central clearing, deepen the risk-absorbing capabilities of CCPs, increase the liquidity and efficiency of OTC derivatives markets, and reduce the impact of the failure of a large global dealer.

A Canadian CCP that is better aligned to Canadian market conditions and risks could be developed. Such a CCP could provide simplified and direct oversight of systemically important financial infrastructure for Canadian-dollar OTC derivatives, particularly for Canadian-dollar interest rate derivatives. It could also provide Canadian authorities with the ability to directly manage policies for liquidity provision and failure resolution. The broad participation of global dealers or links between CCPs is critical to achieving the net benefits of a local CCP by preventing this decentralized approach from fragmenting market liquidity and the management of systemic risk.

In addition, co-operative oversight is essential to provide the foundations for safely expanding access to CCPs and establishing links between CCPs. To deal with shocks that

22 The optimal central clearing solution, in terms of resilience, depends on several factors, such as the degree of integration of the participants in each jurisdiction and the type and magnitude of the shocks (Renault 2010; Zigrand 2010).

a CCP cannot properly manage, co-operative policies are also required for emergency liquidity provision and, in extreme circumstances, failure resolution.

Canadian federal and provincial authorities are working with their international counterparts to promote broader access to central clearing and links between CCPs under stringent CCP risk controls (FSB 2011). Work is also under way with domestic market participants to ensure that the move to increased use of central clearing services for OTC derivatives transactions will reinforce the safety and efficiency of the financial system.

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The Growth of High-Frequency Trading: Implications for Financial Stability

William Barker and Anna Pomeranets

Introduction

High-frequency trading (HFT), which relies on computers to execute trades at high speeds, accounts for approximately one-quarter of all trading in the Canadian equity market, and more than half in the U.S. market.[1] A relatively recent but fast-growing phenomenon, HFT has evolved with the changing structure of financial markets, yet its overall effect on financial markets and stability is not fully understood. For example, while the growth of HFT has been associated with market-wide benefits, it also magnifies certain risks, which may cascade into financial systems and lead to financial instability.

Several policy initiatives are under way in Canada and other jurisdictions to better understand the effects of HFT on markets and to mitigate potential risks. For example, the Canadian Securities Administrators (CSA 2011) "have determined that a regulatory framework is necessary to ensure that marketplace participants and marketplaces are managing the risks associated with widespread electronic trading including high frequency trading."

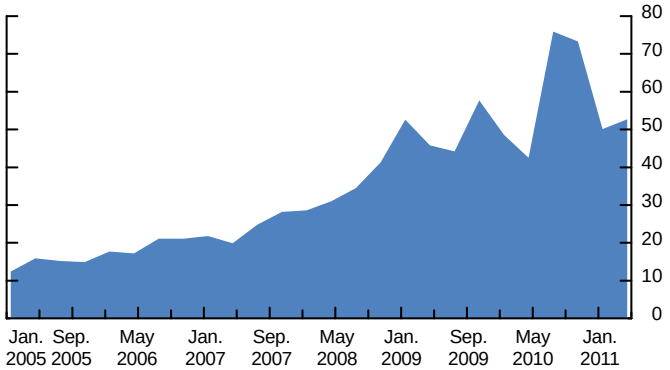
This article explores the HFT landscape, discusses the associated benefits and risks, and examines some of the regulatory responses in Canada. Some background information on HFT is provided in **Box 1**, and a glossary of selected technical terms used in this report is supplied in **Table 1**.

Benefits and Risks of HFT

The "Flash Crash" of 6 May 2010 amplified the debate over the relative merits of HFT, which has preoccupied market participants and regulators for years.[2] Since the advent of HFT, order-to-trade ratios and the volume of daily messages have increased dramatically: the Toronto Stock Exchange (TSX) order-to-trade ratio more than quadrupled between January 2005 and April 2011 (**Chart 1**). This increase is evidence of the growing presence of HFT, which is characterized by a high volume of trade messages relative to the number of trades actually completed. These trade messages may not always represent genuine intent to trade, but are instead designed to obfuscate the price signal in markets in order to generate profitable

Chart 1: The number of submitted orders has grown faster than the number of completed trades on the TSX

TSX order-to-trade ratio



Source: TMX

Last observation: April 2011

1 These estimates for Canada are from the Investment Technology Group (ITG 2010) and do not include proprietary desks at brokerage firms or proprietary trading by clients who do not qualify as electronic liquidity providers. For the United States, Sussman, Tabb and Iati (2009) estimate that HFT accounts for 56 per cent of the trading volume in equities.

2 On that day, the major U.S. equity indexes dropped by over 5 per cent within several minutes, before quickly rebounding. See SEC and CFTC (2010) and IIROC (2010b) for more details. The TSX Composite Index declined 3.8 per cent from the previous day's close.

Box 1

High-Frequency Trading: Definition, Strategies and Development

Definition

High-frequency trading (HFT) is the high-speed execution of automated trading strategies, in which large numbers of trades are conducted in short time spans in order to profit from pricing or other market inefficiencies.

Strategies

HFT encompasses a range of strategies. For example, generating revenues by collecting rebates from exchanges that provide liquidity to the markets; taking advantage of differences in the speed of price quotations; and profiting from price differences and other short-term market anomalies. Because the profit margin on individual trades is relatively small, HFT relies on high-speed trading networks to rapidly turn over a large number of small positions. Positions are typically held for short periods (ranging from microseconds to several seconds), and there are no overnight risk positions.

Development

HFT is widespread in global markets, including markets for equities, foreign exchange (FX), fixed-income, commodities, derivatives and emerging-market assets.[1] It is also present in the Canadian equity and FX markets. Several factors have led to the development of HFT across different markets in recent years, including the following:

- *Technological innovation* permits trading strategies to be executed rapidly and has supported the growth of HFT in every market in which it exists.
- The *proliferation of new trading venues* creates arbitrage opportunities for high-frequency traders. In Canada, for example, there are six equity alternative trading systems (ATSs) and three equity exchanges.[2] As a result, trading of the same securities can take place across multiple venues, creating opportunities for arbitrage.
- *Regulatory change* has introduced trading rules such as decimalization, which altered the minimum tick size (price increment) and created new price discrepancies between trading venues, and the Regulation National Market System, which requires trades to be automatically executed at the best available price, regardless of location.
- *Reduced barriers to entry* have increased access for many new market participants, including HFT players. For example, after dealers in the FX market began offering prime brokerage services, hedge funds and other members of the professional trading community gained access to the interbank price feeds through prime brokers.

1 Sussman, Tabb and Iati (2009) estimate that 83 per cent of U.S. HFT proprietary firms trade in stocks; 67 per cent trade in futures, 58 per cent in options, 36 per cent in U.S. Treasury securities and 26 per cent in FX.

2 There are three equity exchanges and six ATSs in Canada. They are, respectively: TSX, TSX Venture, Canadian National Stock Exchange; and Alpha ATS, Bloomberg Tradebook Canada, Chi-X Canada, Liquidnet Canada Inc., MATCH Now and Omega ATS.

opportunities for the HFT firm. Consequently, an investigation into the risks and benefits associated with HFT is warranted.

While HFT has been associated with certain benefits, such as tighter bid-offer spreads, lower volatility, and increased market resilience and efficiency, it is also accompanied by risks. For example, in its review of the Flash Crash, the Investment Industry Regulatory Organization of Canada (IIROC) found that, following the sudden decline in U.S. equity indexes, the speedy withdrawal from the Canadian market of many participants, including high-frequency traders and electronic liquidity providers, contributed to the decline in liquidity, but did not trigger the crash. In addition, the rapid growth of HFT has the potential to displace traditional market-makers, which could in turn reduce liquidity in times of market stress. Other risks include the potential for HFT to overload market infrastructure and lead to new forms of credit risk.

The benefits

HFT appears to be having a profound impact on market liquidity, and its rise has coincided with an increase in trading volumes, tighter bid-offer spreads and lower market volatility, at least during periods when markets are not experiencing stress. As a result, HFT could contribute to increased market efficiency.

Liquidity—tighter spreads and higher volumes

Although the entry of new market players, such as high-frequency traders, has not been the only factor, a surge in trading volume and a compression of bid-offer spreads has been observed in all markets where HFT is present (Hendershott, Jones and Menkveld 2011). In the FX market, for example, interbank spreads are estimated to have tightened by at least half, depending on the currency pair, and customer spreads have tightened even more

Table 1: Glossary

Term	Definition
Algorithmic trading	The use of computer programs for entering orders based on trade characteristics such as time, price or quantity
Alternative trading system (ATS)	A trading venue that is approved by regulators but is not an exchange
At-market order	An order placed for quick execution at the best available price
Daily messages	The number of quotes, orders, cancellations and trades sent to an exchange
Exchange rebates	Exchanges offer rebates to liquidity providers to compensate them for taking on risk.
Market-maker	A firm or individual who is obligated, either by a contract with the exchange or by their relationship with clients, to submit quotes and maintain a liquid market. In the equity market, for example, traditional market-makers are contractually obligated to make liquid markets, while in the FX market, dealers usually supply liquidity to clients as part of a comprehensive long-term business relationship and face potential reputational risks if they do not do so.
Minimum quote life	Some trading platforms require bids and offers to be posted for a minimum amount of time in order to allow other market participants the opportunity to transact at these prices. For example, in the FX market, the Electronic Broking Services (EBS) interbank trading platform requires that bids and offers in the major currency pairs be posted for a minimum of 250 milliseconds.
Order-to-trade ratio	Ratio of orders to completed trades
Prime broker	A dealer who allows a client to access the wholesale market using the name and credit rating of the prime broker
Regulation National Market System	U.S. regulation requiring trades to be automatically executed at the best available price, regardless of location
Stop-loss order	An order to either buy or sell a security when it reaches a particular price

dramatically. In the U.S. equity market, spreads on high-volume NYSE stocks narrowed between 7.5 per cent and 46.4 per cent between 2005 and 2009 (Weisenthal 2009).

The availability of additional liquidity in equity markets is partly a result of many trading platforms offering fee rebates to HFT players for supplying liquidity.[3] This increased liquidity in turn attracts trading from other clients to these markets. In effect, HFT is now supplying a large proportion of liquidity in many of the most actively traded financial markets.

Lower volatility

There is evidence that the increased presence of HFT has helped to reduce some measures of price volatility. For example, Chaboud et al. (2009) find that algorithmic trading lowers realized volatility in FX markets. Similarly, Brogaard (2010) shows that HFT may have reduced volatility on the Nasdaq. The wide variety of HFT strategies has created at least some trading flows that are uncorrelated with other market activity, increasing the diversification of overall trading flow in the market. A growing share of HFT follows strategies that are based on mean reversion and have counter-flow tendencies. Some trading platforms also report a rising proportion of inter-HFT trading, indicating that not all high-frequency traders have the same strategy. Taken together, this evidence suggests that volatility is not so much a function of the *speed* of trading but of the *type* of trading strategies being practised.

Market resilience

During the Flash Crash, equity prices rebounded more rapidly from the sharp sell-off than they did in previous crash episodes: anecdotal evidence points to the return of high-frequency traders as a contributing factor. Similar rapid rebounds in prices have since been observed in other markets, including the FX market (e.g., the sell-off in dollars-yen on 16 March 2011) and the commodities market (e.g., the "mini crash" in cocoa futures on 1 March 2011). This pattern of rapid recovery in prices following sharp declines contrasts with other periods of market stress when HFT was not present; for example, prices did not rebound as quickly intraday following the sell-off in 1987.

Anecdotal evidence suggests as well that, during the extended market dislocation of the 2007–08 credit crisis, HFT players remained relatively active and helped to support liquidity in spot markets. While many markets were dislocated because of credit constraints, the impact on HFT strategies based on spot markets and short-term positioning was not as great.

Price efficiency

Arbitrage allows HFT to reallocate liquidity efficiently across multiple venues, helping to reduce the potential pricing inefficiencies of a fragmented market structure. Pricing is therefore more transparent and consistent across a wide range of exchanges, with uniformly tight bid-offer spreads (King and Rime 2010). Arbitrage also helps to keep pricing consistent between cash instruments and related derivatives (futures, options, indexes and exchange-traded funds), which contributes to price efficiency.

3 Traders who submit orders to buy or sell securities at a specific price "make" liquidity, while traders who execute existing orders "take" liquidity.

The risks

HFT technologies differ: some are beneficial, others, less so. Some of the less-favourable practices include the tendency of some HFT participants to overload exchanges with trade-messaging activity; use their technological advantage to position themselves in front of incoming order flow, making it more difficult for participants to transact at posted prices; or withdraw activity during periods of pricing turbulence. Concerns about HFT are related to the displacement of traditional market-makers, liquidity in stressed markets, credit risk and infrastructure overload.

Displacement of traditional market-makers

Given that bid-offer spreads have narrowed, some traditional market-makers have allocated fewer resources to market-making or have withdrawn from the business entirely. As a result, HFT is now supplying the majority of liquidity in some markets.

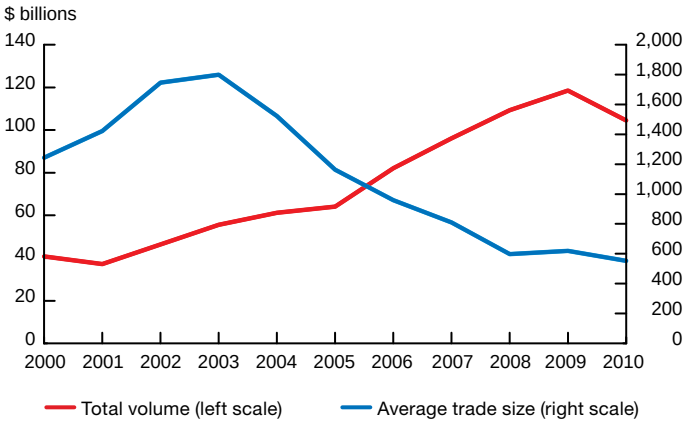
HFT differs from traditional market-making, however, in that HFT firms have no obligation—to their clients or exchanges—to supply liquidity to the market. In fact, any liquidity provided by HFT firms is merely a by-product of their trading. As a result, depending on their strategies, HFT participants may be more likely to withdraw liquidity during periods of market volatility, which can lead to extreme price movements.[4] Yet, empirical evidence suggests that market-makers often take (in addition to providing) liquidity: they make information-based trades and earn profits from non-liquidity-providing practices (Chae and Wang 2003; van der Wel, Menkveld and Sarkar 2009). Therefore, the fact that HFT firms sometimes take liquidity does not prevent them from making markets and, in this respect, demonstrates that high-frequency traders may not be that different from other market-makers.

Liquidity in stressed markets

Although there may be more liquidity for "at-market" orders, anecdotal evidence suggests that, at other price points beyond the best bid and offer, there could be less liquidity to support the market in the event of large price movements. This "liquidity mirage" can quickly vanish following a market shock as HFT accounts pull their orders until the market stabilizes. This reaction can exacerbate price movements, since market participants leave stop-loss orders that automatically trigger selling once certain price points are hit. Consequently, there is a risk that these resting sell orders will reinforce each other in a cascade of selling.

Furthermore, while there has been a surge in volume and a narrowing of the bid-offer spreads, the average trade size has also decreased (**Chart 2**). Whereas the average trade size in 2000 was over 1,200 shares, by 2010 it had declined by more than half, to fewer than 600 shares. This decline suggests that while small orders can be easily executed in the current market, large orders are less likely to be executed quickly at posted prices, particularly in stressed conditions.

Chart 2: Total trading volume has increased on the TSX in recent years, but the average size of trades has declined



Note: Trade size is measured by the number of stocks per trade (right axis).
Source: TMX FactBook 2010 Last observation: December 2010

Moreover, given the interconnectedness of financial markets—between the cash market and derivatives, across different asset classes and across different regions—a failure in one market could propagate quickly throughout the global financial system. During the Flash Crash, for example, the chain reaction of selling started in the futures market but was quickly transmitted to the underlying equity market and other asset classes. This volatility also affected the Canadian dollar, since HFT strategies arbitraged cross-listed shares between the United States and Canada.

Credit risk

Credit risk is also a potential issue for HFT-dominated markets. The average daily trading volume of most HFT firms is typically a large multiple of their capital base, even though HFT participants take only limited outright intraday risk. Therefore, a failure in the HFT firm's trading algorithm could conceivably lead to the rapid accumulation of large, unanticipated risk positions. In the FX market, most HFT accounts access the market through prime brokers, who are expected to monitor their clients' risk positions and collateral postings in real time. However, it is possible that the transactional speed advantage HFT firms have over

4 However, only some HFT players remained active during the slide in prices that occurred during the Flash Crash of 6 May 2010. Once the plunge started, two of the twelve HFT firms mentioned in a Securities Exchange Commission (SEC) report stopped trading for the rest of the day, four curtailed trading activity for periods ranging between 1 and 21 minutes, and six scaled back trading activity but otherwise stood their ground. One of these (Getco LLC) was active throughout the worst of the selling pressure.

their prime brokers may allow risk to accumulate more quickly than either the dealer or the exchange can control. This could lead to unsettled trades, the quick erosion of the HFT firm's capital position and a default risk for HFT prime brokers.

While this type of risk accumulation may not cause undue concern under "normal" market conditions, during periods of market turbulence, a typical spike in trading volumes can lead to processing delays at exchanges.

System failure and infrastructure overload

Systemic risk could arise if the market infrastructure fails to handle the large volume of transactions. Both pre-trade infrastructure, such as trading systems, and post-trade infrastructure, such as clearing and settlement systems, are exposed to high-volume, high-speed HFT strategies. Should these infrastructures become overwhelmed, this could present a market-wide threat that could pose systemic risk. The increased strain on market infrastructure could lead to latency in both pricing and trade settlements. This, in turn, could obstruct the clearing and settlement systems, which might cause errors, potentially halt transactions and interfere with the proper functioning of market infrastructure.[5] While HFT did not trigger the Flash Crash, for example, the sheer volume of trades caused some exchanges to fall behind in processing trades and posting prices. The IT capabilities of the markets' infrastructure are being continually challenged by the increase in HFT.

Mitigating the Risks

A variety of measures have been proposed or enacted by exchanges and trading platforms—to varying degrees between markets—to maintain trading integrity in the marketplace.

To limit manipulative behaviour, some trading platforms, primarily in FX markets, have imposed penalties for failing to meet minimum fill ratios. Another measure to reduce excessive trade messaging limits the number of messages that can be sent in a given time period. In addition, some trading platforms try to reduce the speed advantage of HFT messaging by imposing minimum quote lives for posted bids and offers. In equity markets, exchanges provide incentives for HFT players to post genuine liquidity by rewarding them with exchange fee rebates for supplying liquidity.

In addition, some exchanges have implemented circuit breakers, which suspend trading activity after certain price movements. This allows traders to assess the situation and rebalance their order books.

Exchanges, dealers, trading platforms and prime brokers have a vested interest in maintaining orderly market conditions, and the measures they have implemented to limit disruptive trading behaviour by HFT (and other) accounts have helped to improve market integrity. A number of markets have "best practice" codes enforced by exchanges, prime brokers and market committees. Nonetheless, given that HFT's share of overall market activity is growing and because its implications are still not fully understood, especially during periods of market stress, some degree of public oversight is still desirable.

Regulatory support may be needed to coordinate many of the policies designed to limit disruptive market behaviour. For example, price volatility during the Flash Crash may have been exacerbated by differences in the trading controls employed between platforms, leading to distortions in the flow of liquidity that day. These potential distortions may become proportionally more important as HFT links more trading venues, financial products and regional markets. Such coordination should nonetheless take account of the fact that every financial market has its own characteristics that require individualized monitoring and controls.

Regulated vs. unregulated markets

Different markets currently operate with varying levels of regulatory oversight. While the equity market imposes formal regulations on its participants and closely monitors their behaviour, self-regulated markets such as FX markets often have their own codes of conduct that are enforced throughout the various stages of the trading process.

In equity markets, Canadian authorities have taken several steps to increase market surveillance. For example, IIROC launched the Surveillance Technology Enhancement Platform (IIROC 2010a), an advanced system for monitoring trading activity in equity markets. More recently, the CSA (2011) acknowledged the increasingly important role that electronic trading plays in markets, and on 8 April 2011, proposed rules that introduce "provisions governing electronic trading by marketplace participants and their clients." Both of these measures serve as regulatory vehicles for monitoring and mitigating potential risks associated with the changing structure of equity markets.

Self-regulated markets carry a low regulatory burden but must comply with codes of conduct that are enforced throughout the trading process. For example, HFT accounts operating in FX markets face at least three levels of trading controls. First, HFT firms have their own risk-management systems. Second, HFT firms typically access markets through prime brokers, who also impose controls on risk management and trading.[6] HFT accounts

5 Market dislocation from system overload also occurred before the advent of HFT (i.e., 1987).

6 Dealers have made great strides in improving the sophistication of their risk-management systems to better monitor HFT risk exposure and collateral positions in real time.

trade using both the name and credit of their prime brokers who, in turn, are given incentives to monitor client behaviour for unacceptable trading practices that might generate legal and reputational risks. This is not entirely different from HFT in the equity markets, where many dealers offering direct electronic access to HFTs have put risk-management and trading controls in place as well. Finally, the interbank market platforms, such as Reuters and Electronic Broking Services (EBS), limit aggregate trading exposure and shut off access to prime broker clients reaching trading limits.[7] While these trade controls are generally beneficial in limiting risk, this is not a cause for false confidence: they do not remove the need for vigilance in monitoring and controlling risk.

The range of regulations in place across markets can be attributed in part to the differences between markets. FX markets, for example, are much larger, more global and deeper than equity markets, and comprise a diverse array of participants (e.g., retail, corporate, institutional and sovereign wealth funds). The controls imposed in every market are thus geared toward its structure and participants.

Conclusion

HFT is playing a significant role in markets today. It began in equities and rapidly spread to other asset classes, such as FX, linking these markets through cross-asset-class trading strategies and heightening concerns about its relative merits. Yet the overall impact of HFT on financial markets and its ability to penetrate further into financial systems remains unclear.

Although there are benefits associated with HFT, its effects are not yet fully understood, in terms of either growing market penetration or stressed markets. HFT has therefore created new challenges for public policy-makers, who will have to monitor and address the potential risks that HFT poses to financial markets and financial stability. While self-regulated markets may be more likely to address these risks independently, other markets may require a regulatory push. In either case, public input and coordination between various financial markets and jurisdictions will be necessary to avoid unintended consequences.

7 These controls are not mandated on some of the electronic communication networks that HFT accounts use to trade FX, but these platforms are generally only secondary sources of liquidity in FX markets, behind EBS and Reuters.

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Abbreviations

A more comprehensive list of financial and economic terms, as well as information on Canada's payment clearing and settlement systems is available at <http://www.bankofcanada.ca>.

ABCP: Asset-backed commercial paper

ABS: Asset-backed security

ATS: Automated trading system

BIS: Bank for International Settlements

CCP: Central counterparty

CGFS: Committee on the Global Financial System

CMB: Canada Mortgage Bond

CMHC: Canada Mortgage and Housing Corporation

CDO: Collateralized debt obligation

CPSS: Committee on Payment and Settlement Systems

CFTC: Commodities Futures Trading Commission

CRA: Credit-rating agency

CSA: Canada Securities Administrators

DBRS: Dominion Bond Rating Service

DSR: Debt-service ratio

EFSF: European Financial Stability Facility

ETF: Exchange-traded fund

EU: European Union

FSB: Financial Stability Board

FSF: Financial Stability Forum

FX: Foreign exchange

G14: 14 largest derivatives dealers

G-20: Group of 20 countries

GDP: Gross domestic product

GSE: Government-sponsored enterprise

G-SIFI: Globally systemically important financial institution

HFT: High-frequency trading

IASB: International Accounting Standards Board

IFRS: International Financial Reporting Standards

IIROC: Investment Industry Regulatory Organization of Canada

IMF: International Monetary Fund

IOSCO: International Organization of Securities Commissions

IRS: Interest rate swap

MBF: Market-based financing

MBS: Mortgage-backed securities

MMMF: Money market mutual fund

NHA MBS: National Housing Act Mortgage-Backed Securities

OSFI: Office of the Superintendent of Financial Institutions

OTC: Over–the-counter

SEC: Securities and Exchange Commission

S&P: Standard & Poor's