BANK OF CANADA
BANQUE DU CANADA

Financial System Review

June 2012

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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.

This report includes data received up to 8 June 2012.

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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 FSR, 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.

Overview

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

Conditions in the international financial system are fragile. Over the past six months, financial conditions have gone through two distinct phases: a significant but short-lived improvement resulting from the European Central Bank's (ECB) liquidity provisions in December and February, followed by a period of mounting market turbulence as sovereign debt concerns in Europe re-escalated. These concerns reflect widespread doubts about the capacity and resolve of policy-makers to address unsustainable fiscal situations, the capital adequacy of some euro-area banks and the underlying balance-of-payments problems within the euro area. If these issues are not dealt with in an orderly way, the contagion effects on global financial conditions could be significant.

Canada's financial system continues to be robust despite the challenging global environment. In contrast to the volatility in European credit markets, markets in Canada have been relatively stable, and Canadian banks continue to have good access to wholesale funding markets. Nevertheless, a further significant deterioration in global financial conditions could have a considerable impact here in Canada through trade, financial and confidence channels.

The Governing Council judges that the risks to the stability of Canada's financial system remain high, as in December. The sources of the key risks are broadly the same as those highlighted at that time and emanate primarily from the external environment (**Table 1**):

- a further escalation of the euro-area sovereign debt crisis;
- an economic slowdown in other advanced economies;
- financial stress in the Canadian household sector;
- a disorderly resolution of global current account imbalances; and
- excessive risk-taking associated with a prolonged period of low interest rates.

The key risks to financial stability are highly interdependent and mutually reinforcing. If the sovereign debt crisis in Europe continues to intensify, it would further weaken global economic growth and prompt a general retrenchment from risk. In turn, the weaker global outlook would fuel sovereign fiscal strains and impair the credit quality of bank loan portfolios. The

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

Euro-area sovereign debt	↔
Economic weakness in other advanced economies[a]	
Canadian household finances and the housing market	↔
Global imbalances	↓
Low interest rate environment in major advanced economies	↔
Overall level of risk	↔

a. Since the scope of this risk has been redefined, it is not comparable to the assessment in the December FSR.

Legend

Level of risk
- Very high
- High
- Elevated
- Moderate

Direction of risk (change since December FSR)
- ↑ Increased
- ↔ Unchanged
- ↓ Decreased

rise in risk aversion would exacerbate pressures on bank balance sheets and could prompt a tightening in lending conditions to households and businesses, adding to the drag on global economic growth. Together, these factors would increase the probability of an adverse shock to the income or wealth of Canadian households. Diminished prospects for growth would also foster expectations of continued low interest rates, potentially further eroding the financial positions of life insurance companies and defined-benefit pension plans, and boosting household borrowing in Canada.

Mitigating the risks to the stability of the international financial system requires a number of policy actions. The most pressing near-term priority is to contain the resurgent crisis in the euro area. Euro-area banks need to be adequately and transparently capitalized. In addition, the financial firewalls (the European Financial Stability Facility (EFSF) and the European Stability Mechanism (ESM)) need to be reinforced and made fully operational to alleviate contagion. Beyond these immediate steps, actions need to be taken by both deficit and surplus countries to address the underlying balance-of-payments imbalances in the euro area. In particular, structural and product market reforms to reduce rigidities and facilitate adjustments in relative wages within the euro area and boost long-term growth must be fully implemented. There also needs to be a clearer path for risk mutualization and enhanced fiscal governance arrangements within the European monetary union. Ongoing discussions about deepening the union, if fully developed, would help address Europe's problems.

At a global level—and consistent with the G-20 commitments—current account imbalances have to be addressed to help foster sustainable and balanced global economic growth. Among other things, this will require a more decisive move toward market-determined exchange rates by economies with current account surpluses, notably China.

In Canada, the high indebtedness of the household sector and elevated valuations in the housing market require continued vigilance. These conditions make households especially vulnerable to adverse shocks. Building on the Financial Stability Board's (FSB) "FSB Principles for Sound

Residential Mortgage Underwriting Practices,"[1] in March, the Office of the Superintendent of Financial Institutions (OSFI) released a draft guideline for mortgage underwriting by federally regulated financial institutions in Canada.[2] These institutions need to actively monitor risks in their loan and asset portfolios, and adhere to the new mortgage-lending standards. Households need to be cognizant of the fact that borrowing rates will eventually normalize and ensure that they will be able to service new and existing debt over the duration of their loans.

The current environment should not be an excuse to delay or dilute the broader financial reform agenda to make the global financial system more resilient. Timely, comprehensive and consistent implementation of the Basel III capital rules is a key priority. Canadian banks plan to implement these rules at the beginning of the agreed-upon phase-in period, which starts in 2013. Establishing a resilient market infrastructure is also important to reduce the likelihood and consequences of future periods of financial system turmoil. The development of a central counterparty for repos in Canada, launched on 21 February, is a significant step in this direction. Progress has also been made in mitigating systemic risk and improving transparency in over-the-counter derivatives markets. International standards and policy work to support reform in this market are largely complete, and efforts are well advanced in implementing safeguards to strengthen the safety of global clearing infrastructure. Financial stability also requires that credible frameworks for resolution are in place so that all banks, even those that are large and complex, can be resolved in a timely and orderly manner. The FSB's "Key Attributes of Effective Resolution Regimes for Financial Institutions,"[3] endorsed by the G-20 leaders in November 2011, is an important step forward on this issue.

1 This document is available at <http://www.financialstabilityboard.org/publications/r_120418.pdf>.

2 OSFI's Draft Guideline B-20, "Residential Mortgage Underwriting Practices and Procedures," is available at <http://www.osfi-bsif.gc.ca/app/DocRepository/1/eng/guidelines/sound/guidelines/b20_dft_e.pdf>. The final version of the guideline will be published in the near future.

3 This document is available at <http://www.financialstabilityboard.org/publications/r_111104cc.pdf>.

Risk Assessment

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

Macrofinancial Conditions

The global recovery remains modest, fragile and uneven. Over the past six months, economic momentum has been solid in Canada, and the U.S. economy has continued to grow at a modest pace. In Europe, however, economic activity is expected to remain sluggish owing to the drag from fiscal austerity, bank deleveraging and weak confidence. Growth in China and other emerging-market economies has moderated.

Global financial conditions remain fragile and uncertainty is heightened

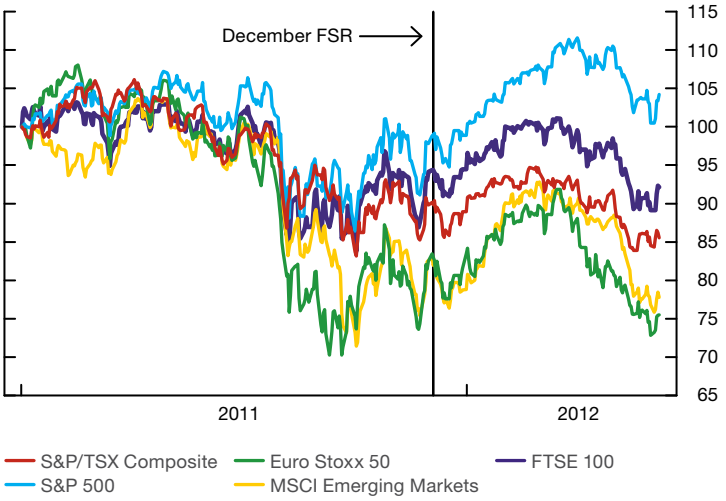
Conditions in global financial markets improved between December and March but have come under renewed stress in recent months. The initial improvement reflected a number of developments. The ECB's long-term refinancing operations (LTRO)—conducted in December 2011 and February 2012—injected around €500 billion of net liquidity into the banking system,[4] enough to address euro-denominated bank funding needs until the end of 2012. These operations significantly lowered the region's bank funding costs. Expanded provision of U.S.-dollar swap lines by central banks in early December also helped to ease the stresses on euro-area bank funding. Improved funding conditions for banks provided additional support to sovereign debt markets. The orderly completion of the Greek debt restructuring—which constituted a credit event but did not generate adverse market reactions—further calmed sovereign debt markets. Finally, the increase in the combined lending capacity of the EFSF and the ESM to €700 billion (from €500 billion previously)[5] and a tentative agreement on the European Union Fiscal Compact were favourably received by sovereign debt markets. Together, these developments led to a broad-based reduction in risk aversion. Equity prices increased globally between December and March (**Chart 1**), while corporate bond spreads narrowed (**Chart 2**).

4 This number is the net amount after adjusting for existing borrowing from the European Central Bank (ECB) that was rolled out of short-term operations (such as the main refinancing operations with a maturity of one week). In addition, the range of collateral accepted by the ECB was broadened to enhance the ability of financial institutions to access the ECB's facilities.

5 Of which €500 billion represents the permanent lending capacity of the European Stability Mechanism. The remaining €200 billion consists of existing commitments to Greece, Ireland and Portugal.

Chart 1: After a strong start in 2012, global equity markets have declined in recent months

Equity indexes (1 January 2011 = 100)

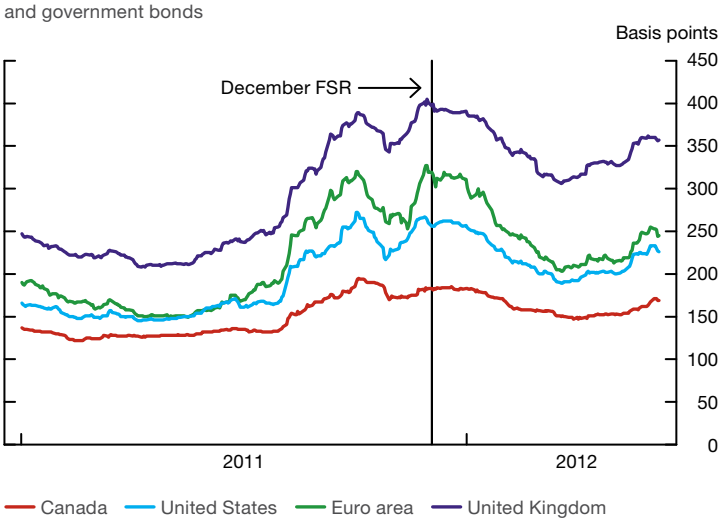


Source: Bloomberg

Last observation: 8 June 2012

Chart 2: Spreads on investment-grade corporate bonds are narrower than in December, but are now widening amid market concerns

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



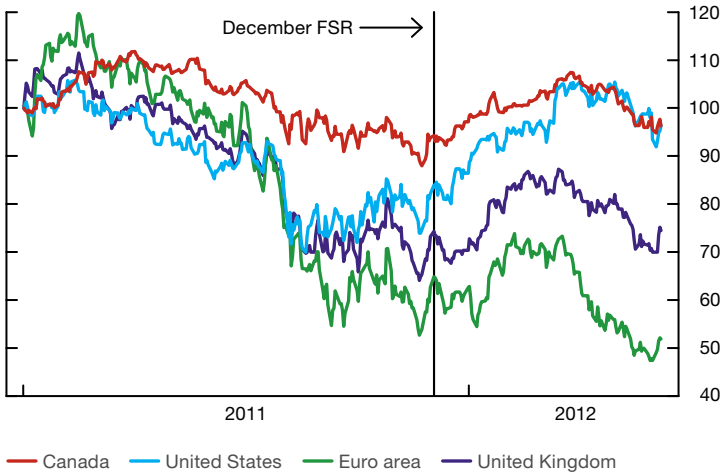
Sources: Bloomberg and Bank of America Merrill Lynch

Last observation: 8 June 2012

Investor concerns about the euro area have re-emerged, however, weighing on financial markets. This reflects a number of growing interrelated issues, including a potential disorderly exit of Greece from the euro area, bank capital adequacy and fiscal sustainability in Spain, and the adequacy of the EFSF/ESM firewall. Consequently, since March, European equity markets—and bank stocks in particular—have underperformed other regions (**Chart 3**). Measures of implied and realized volatility across financial markets in Europe have also moved up, reflecting heightened uncertainty, and are close to December levels (**Chart 4**). Meanwhile, spreads on sovereign credit default swaps for Italy and Spain have moved above the levels recorded in early December (**Chart 5**).

Chart 3: Euro-area bank equity prices have underperformed relative to global peers

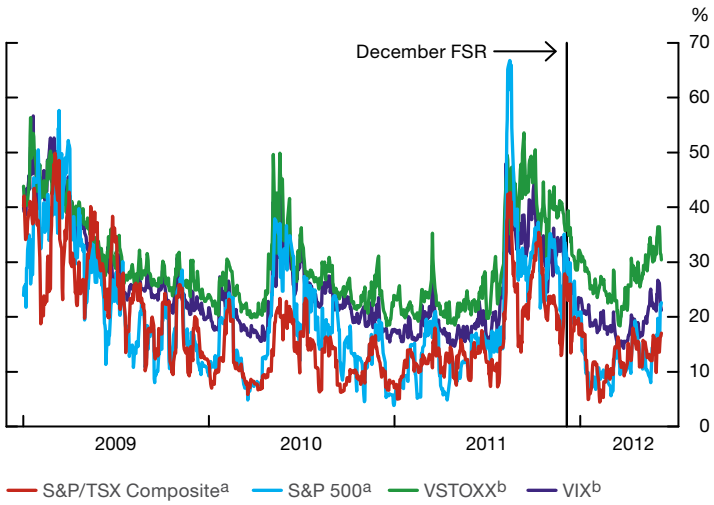
Bank equity indexes (1 January 2011 = 100)



Source: Bloomberg

Last observation: 8 June 2012

Chart 4: Market volatility is lower than in December, but is rising



a. The S&P 500 and the S&P/TSX Composite volatility measures are based on 10-day historical volatility.
b. The VIX and VSTOXX indexes are measures of the implied volatility obtained from options contracts on the S&P 500 Index and the Euro Stoxx 50 Index, respectively.

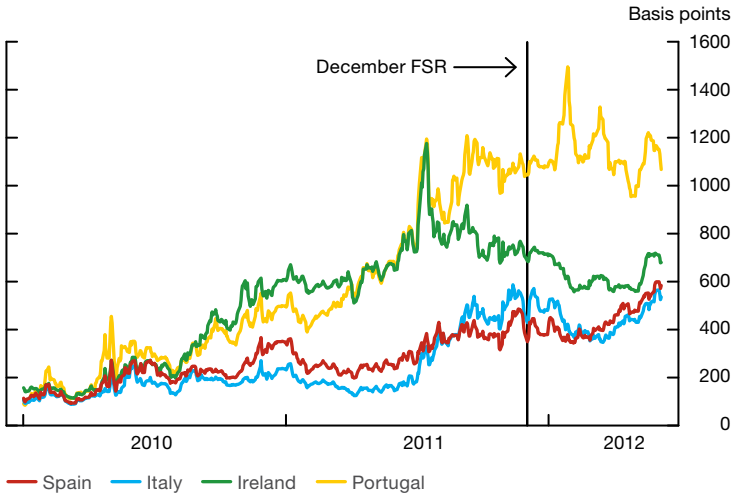
Source: Bloomberg

Last observation: 8 June 2012

Despite the swings in investor sentiment, financial conditions in Canada remain very stimulative. In particular, issuance in Canadian credit markets has been robust, and the country's banks continue to retain access to both secured and unsecured funding at reasonable rates. In addition, lending conditions for businesses remain favourable. The Bank of Canada's *Senior Loan Officer Survey* for the first quarter of 2012 showed an easing in both price and non-price lending conditions for all classes of borrowers. Larger firms in Canada also continue to enjoy good market access to credit as corporate bond yields have remained near historic lows.

Chart 5: Sovereign debt concerns remain elevated in the euro area

Spreads on 5-year sovereign credit default swaps



Source: Markit

Last observation: 8 June 2012

Key Risks

This section explores each of the risks that the Governing Council judges to be the most important for the stability of the Canadian financial system. The sources of the key risks are broadly the same as those noted in the December FSR and emanate primarily from the external environment. Although the risks are interrelated and mutually reinforcing, the following discussion focuses on the underlying vulnerabilities that are distinct for each risk.

Euro-Area Sovereign Debt

The principal threat to domestic financial stability continues to stem from sovereign debt strains in the euro area. Following a brief interlude earlier this year, the situation has reintensified. Political uncertainties in Greece have given rise to concerns that its policy programs will not be successfully implemented, and even to fears about the possibility of its exit from the common currency zone. The adequacy of bank capital in some jurisdictions, notably Spain, has also been at issue. At the same time, weakening growth prospects are making fiscal consolidation more challenging for a number of stressed euro-area economies. The risk is that these pockets of stress could intensify further and spread across Europe. If that were to occur, the spillover effects to Canadian financial institutions would be substantial, in the form of higher funding costs and higher markdowns on direct and indirect exposures to the affected economies. In addition, such an event would have a major adverse impact on the Canadian economy, which would lead to increased losses on domestic loans. The Governing Council judges that the risks from the debt dynamics in the euro area remain very high, as at the time of the December FSR.

After a brief respite, sovereign strains in the euro area have flared up again

The deterioration of the European situation in recent months, following the temporary improvement noted earlier, is being driven by a confluence of factors. These include the political turmoil in Greece subsequent to the May

elections and, more generally, the absence of broad-based public support for the implementation of the agreed-upon program of adjustment measures and structural reforms. These factors give rise to doubts about Greece's future in the euro area, and the associated concern that a Greek exit could be viewed as a precedent for other stressed countries.

These uncertainties surrounding the situation in Greece are compounding the challenges faced by Spain, where questions about capital adequacy and the resilience of some banks, together with elevated unemployment rates and elusive economic growth, are adding to concerns about fiscal sustainability. Bank funding pressures have intensified with the rating downgrade of a number of Spain's banks and the decision on 25 May to nationalize Bankia. These developments have led the Spanish government to commission an external audit of the financial system to mitigate investor uncertainty about the health of the country's banking sector, and—more recently—to an agreement with the Eurogroup for up to €100 billion in financial assistance to help recapitalize the country's financial institutions.[6]

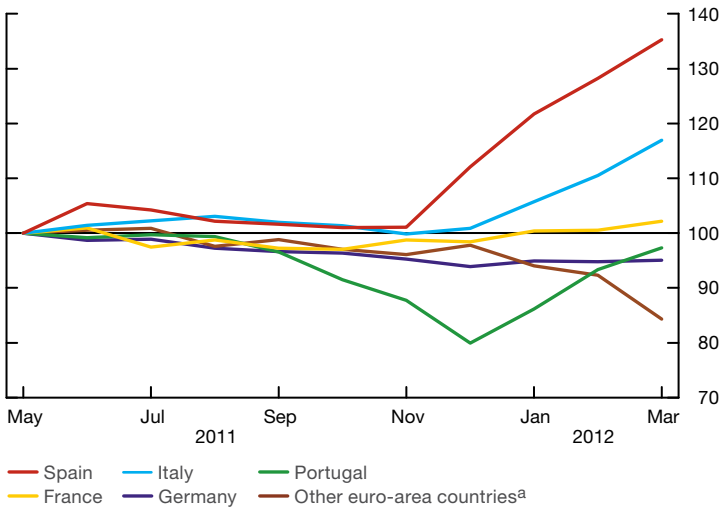
Sovereign debt strains could be amplified through banks and markets

Two key vulnerabilities in the euro-area financial system are the closer linkages between the banking and sovereign sectors in some countries and the susceptibility of euro-area banks to stresses in funding markets.

Since December, the linkages between banks and sovereigns in stressed euro-area countries have strengthened, leading to a greater concentration of risk. National banking data indicate that the holdings of sovereign debt by euro-area banks increased noticeably following the LTRO (**Chart 6**), with a significant home bias—for example, Spanish banks have primarily increased their holdings of Spanish sovereign debt, and Italian banks their holdings of Italian sovereign debt.

Chart 6: Holdings of sovereign debt by Spanish and Italian banks have increased noticeably

Index: May 2011 = 100



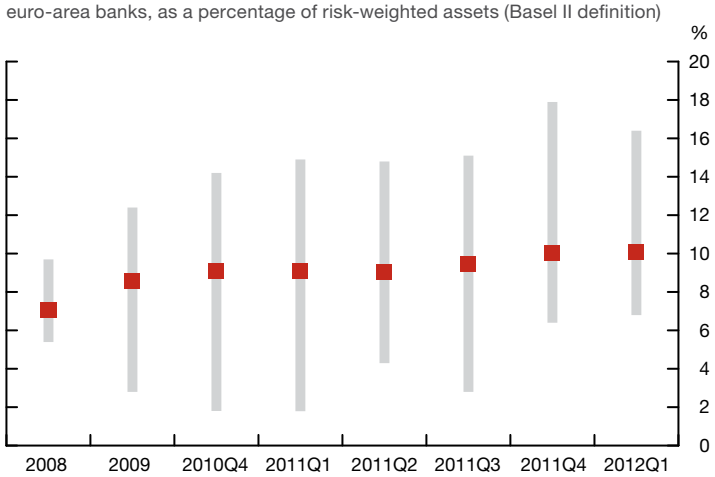
a. "Other euro-area countries" refers to Ireland, Belgium, Austria, the Netherlands, Finland and Greece. The index was calculated as a simple average of indexes for individual countries.

Source: DataStream Last observation: 30 March 2012

6 An IMF report released on 8 June suggested that Spanish banks would need an additional €37 billion in capital to cover losses in a deteriorating domestic economy.

Chart 7: Euro-area banks have increased their capital positions, but concerns remain

Comparison of maximum, minimum and median Tier 1 capital ratios of euro-area banks, as a percentage of risk-weighted assets (Basel II definition)



Note: The red boxes represent median Tier 1 capital ratios. The vertical lines indicate the maximum and minimum Tier 1 capital ratios for a representative group of euro-area banks.

Source: Bloomberg Last observation: 2012Q1

While euro-area banks continue to increase their Tier 1 capital ratios (**Chart 7**)—largely in response to directives from the European Banking Authority—these banks remain vulnerable to adverse shocks. Concerns are focused on whether the improved capital positions are sustainable and provide adequate capacity for loss absorption, given the prospects for European recession, as well as on the capacity of banks to raise funds in periods of stress.

A number of euro-area banks have scaled back operations in non-core markets and businesses, reducing their assets and thereby helping to push up their capital ratios.[7] While asset disposal can provide a one-time increase in capital levels, it may not be a viable strategy for ongoing improvements in capital positions. Moreover, some banks have sold assets that strongly contributed to earnings; as a result, the ability of these banks to generate capital internally may be reduced in the future—further limiting their ability to improve their capital positions through equity issuance.

In addition, non-performing bank loans in the euro area remain historically elevated (**Chart 8**) and, given the weak economic outlook in Europe, the number of problem loans may rise even further.

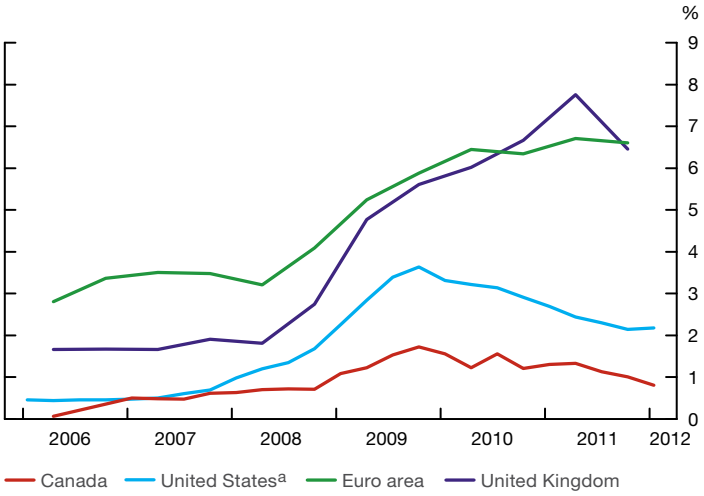
The greater reliance of euro-area banks on secured funding is also of concern.[8] According to private sector estimates, roughly €4.5 trillion of the high-quality assets of European banks—i.e., around 20 per cent of total available assets—have already been pledged as collateral (i.e., encumbered) to support covered bonds (€3.5 trillion) and lending by central banks (€1 trillion). As a result, euro-area banks have fewer high-quality unencumbered assets left to use during periods of stress. This may lead to sharply higher funding costs for European banks if they are faced with an adverse shock.

7 For example, in late 2011, Santander sold its Colombian banking operations and Santander Consumer USA, while BNP Paribas sold its U.S. energy-lending portfolio to Wells Fargo Bank.

8 In part, this is a global trend, whereby financial institutions are moving from unsecured to secured sources of funding, driven by structural factors (new banking regulations and the introduction of covered-bond legislation in a number of countries) and cyclical factors (near-term risks and market volatility).

Chart 8: Non-performing loans at euro-area banks remain elevated

Non-performing loans as a percentage of total loans



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

Source: Bloomberg

Last observations: Canada and United States, 2012Q1; other countries, 2011H2

The adverse dynamic between weak economic growth and fiscal austerity will continue to constrain improvements in fiscal balances

The weakening economic outlook in Europe has made the task of fiscal consolidation facing some euro-area countries more daunting. This outlook is, in turn, being dampened by the deleveraging process, as is reflected in the tightening of credit conditions for households and businesses in the euro area in the second half of 2011.[9] The International Monetary Fund's (IMF) April 2012 projections of global fiscal balances highlight the interplay between multi-sector deleveraging, economic activity and national indebtedness. Despite planned fiscal consolidation, sovereign debt levels are projected to continue rising for a number of euro-area economies (**Chart 9**). In particular, the gross government debt-to-GDP ratio for Spain is projected to increase from 69 per cent in 2011 to 89 per cent by 2015.[10] Similarly, fiscal indebtedness in Portugal is forecast to rise to 113 per cent by 2015 from its current level of 107 per cent.

Concerted and decisive policy efforts are needed to address sovereign debt issues in the euro area

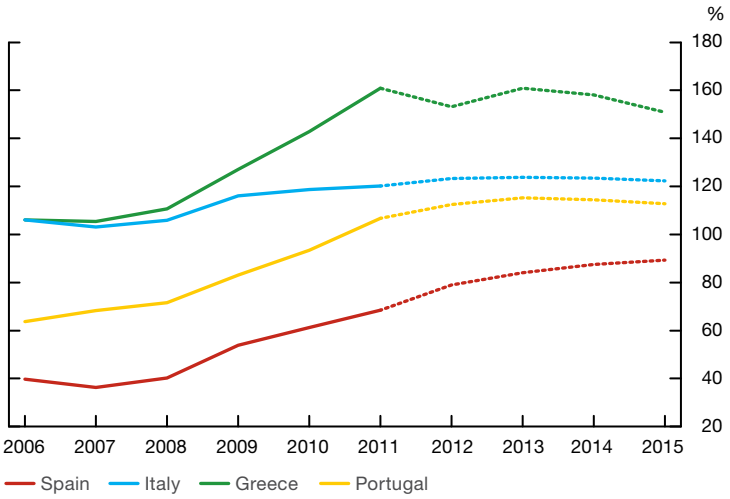
Recent events have demonstrated that actions by central banks, the IMF and the EFSF/ESM can only create time for the policy actions needed to bring about a lasting solution to the euro-area sovereign debt crisis. Perseverance in fiscal adjustment is necessary but not sufficient. Action is also needed to rebuild the single European financial market on a more robust foundation, as suggested by recent discussions of proposals to create a banking union—centralizing bank restructuring; recapitalizing banks with European, rather than national, resources; moving toward centralized (or federalized) supervisory oversight; and harmonizing deposit insurance. The euro-area leaders' agreement on 9 June to recapitalize the Spanish banking system could be a step toward establishing such a union. In addition, there is a need for further

9 This is in contrast to trends in other advanced countries, such as the United States, Canada and Japan, where credit conditions for domestic borrowers have continued to improve over recent quarters.

10 These projections do not include potential impacts from the financial assistance to the Spanish banking system as agreed upon by Spain and the euro-area leaders on 9 June.

Chart 9: Sovereign debt levels are projected to continue rising in a number of euro-area economies

General government gross debt as a percentage of nominal GDP

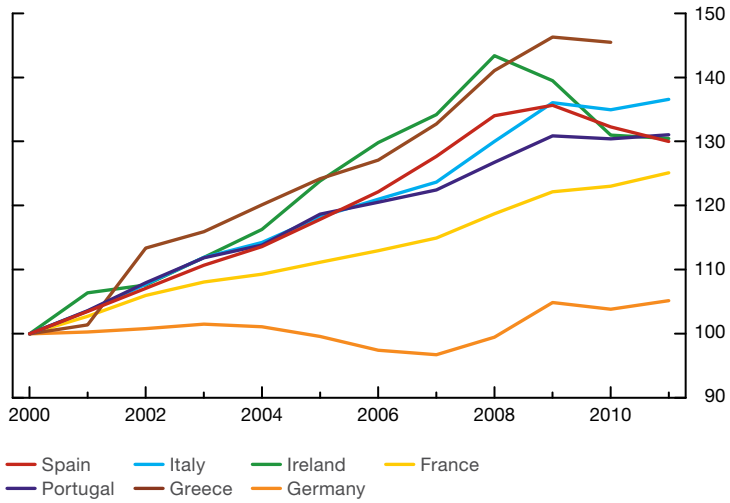


Notes: General government gross debt includes claims on all levels of government. Broken lines indicate IMF projections.

Source: IMF *Fiscal Monitor*, April 2012 Last data point plotted: 2015

Chart 10: Competitiveness remains an issue for many euro-area countries

Unit labour costs (2000 = 100)

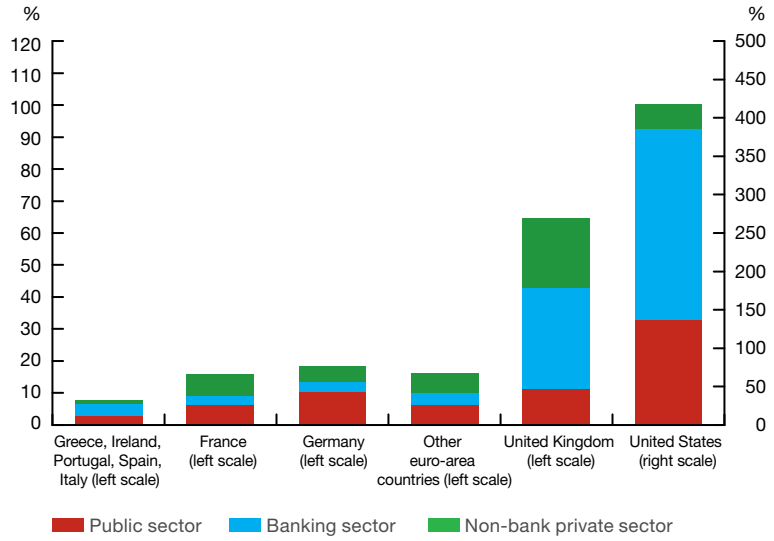


Sources: Instituto Nacional de Estadística, Istituto Nazionale di Statistica, Central Statistics Office, Institut National de la Statistique et des Études Économiques, Instituto Nacional de Estatistica, National Statistical Service of Greece and Deutsche Bundesbank Last observation: 2011

measures to achieve the needed balance-of-payments adjustment. Within a single-currency area, this adjustment involves a process characterized as "internal devaluation"—a combination of fiscal, product market and structural reforms to improve competitiveness in stressed countries (**Chart 10**). These reforms should include measures to reduce labour market rigidities that impede the mobility of resources and adjustments in wages. Although some of the structural adjustments will take time to bear fruit, and may have negative transitional effects on economic activity in some countries, they are necessary to address the core problems that precipitated the current imbalances in the euro area.

Chart 11: Canadian banks have limited direct exposure to credit claims on entities from stressed European countries

Cross-border claims of Canadian domestic banks as a percentage of total Tier 1 capital, by sector, on an ultimate-risk basis



Source: Regulatory filings of Canadian banks

Last observations: Cross-border exposures, March 2012 for all banks;
Tier 1 capital, December 2011 for December year-end banks and January 2012 for October year-end banks

Despite its relative strength, the Canadian financial system is vulnerable to sovereign debt strains

Canada has fared well during this period of stress in Europe, for a number of reasons. Canada's total government net debt-to-GDP ratio (which includes federal, provincial and territorial debt, as well as the Canada Pension Plan and the Québec Pension Plan) remains the lowest among the G-7 countries.[11] As well, the balance sheets of Canadian financial institutions are in better shape than many of their global peers, with the result that funding conditions for Canadian banks have remained generally favourable. In particular, unlike some European banks, Canadian banks have retained access to both domestic and foreign funding markets (both secured and unsecured) at low cost.

In addition, the direct exposure of Canadian banks to the affected European countries is limited (**Chart 11**). In particular, Canadian banks' exposure to entities in Greece, Ireland, Portugal, Spain and Italy accounts for only 8 per cent of their Tier 1 capital. Consequently, to date, there have been limited writedowns by banks, and the provision of credit to households and businesses in Canada has not been affected.

However, should the crisis worsen and spread further across Europe, the impact on the Canadian financial system could be significant. This could come about through three interrelated channels. First, a decline in confidence would lead to a general retrenchment from risk and push up the cost of, and/or curtail the availability of, wholesale funding for financial institutions. This would prompt a tightening of lending conditions by the affected institutions. Second, Canadian financial institutions would incur losses as they mark down their holdings of assets that are affected by direct and indirect exposures to stressed European entities. The indirect impacts could become especially important if entities in the United States

11 See the IMF *Fiscal Monitor*, April 2012.

were significantly affected by the crisis. Third, heightened stress in global sovereign debt markets would weaken economic activity—both abroad and domestically—and increase non-performing loans at banks. The combined effect of these events could constitute a major shock for both the Canadian financial system and the economy as a whole.

Economic Weakness in Other Advanced Economies

Owing to the continued modest growth in economic activity in advanced economies, the process of balance-sheet repair in many of these countries remains protracted. As a result, financial institutions are still vulnerable to adverse macroeconomic developments. Such vulnerabilities, while they are gradually being reduced, are still significant in view of the elevated level of risks to the global economy. Independent of the euro-area risks already discussed, the other important downside risks include the impending "fiscal cliff" in the United States and a hard landing in emerging-market economies. If either of these risks were to materialize, the resulting slowdown in global economic growth would have adverse effects on bank capital and would render the ongoing financial sector balance-sheet repair in a number of advanced economies even more difficult.

While Canadian banks are well capitalized, adverse global macroeconomic shocks would affect the Canadian financial system primarily through a combination of trade, financial and confidence channels. The risk to the Canadian financial system from economic weakness in the advanced economies outside of Europe is judged to be elevated.[12]

Weakness in the housing market continues to weigh on the U.S. banking sector

The U.S. banking system has recovered markedly since the crisis (**Chart 12**), as suggested by the results of the 2012 U.S. bank stress test.[13] However, the recovery is still being hampered by the continuing malaise in the residential housing market. Banks in the United States have maintained the same level of exposure to residential real estate—around 40 per cent of their total loan books—since 2006.[14]

The housing market has remained weak since December, and house prices are about 30 per cent below their pre-crisis peaks. About 10 per cent of housing-related loans are either delinquent (i.e., 30 days or more in arrears) or in some stage of foreclosure (**Chart 13**). In addition to non-performing housing loans, U.S. banks hold a sizable number of "real estate owned" (REO) properties, which are part of the U.S. shadow housing inventory.[15] REO are properties that are associated with defaulted mortgages and that have not been disposed of following foreclosure proceedings. At an estimated 400,000 units, the volume of REO properties was broadly unchanged over the second half of 2011.

The number of REO properties is strongly influenced by developments in housing activity and prices. If the housing market remains soft (or worsens), an increasing number of the currently delinquent mortgages would default. At the same time, banks would find it difficult to sell defaulted properties at favourable prices. This would lead to a rise in the REO properties held by banks.

12 The scope of this risk has been redefined relative to the previous FSR, as concerns related to economic weakness in Europe are now incorporated in the euro-area sovereign debt risk.

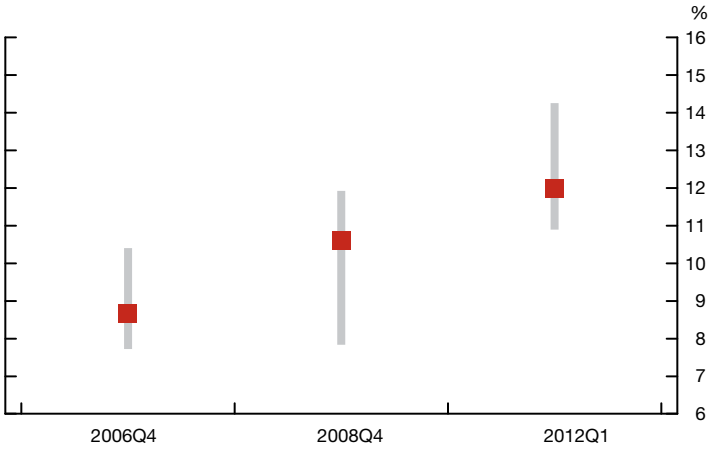
13 Under the U.S. stress test, only 3 of the 19 participating banks were projected to fall below the supervisory benchmark for the Tier 1 Common Capital Ratio at the end of the stress horizon (2013Q4).

14 Real estate exposures include mortgage loans and home-equity lines of credit held on and off balance sheets.

15 The shadow housing inventory is the pending supply of distressed properties not currently listed for sale that are seriously delinquent (90 days or more in arrears), in foreclosure, and REO.

Chart 12: Capital levels at U.S. banks have improved, but vary across banks

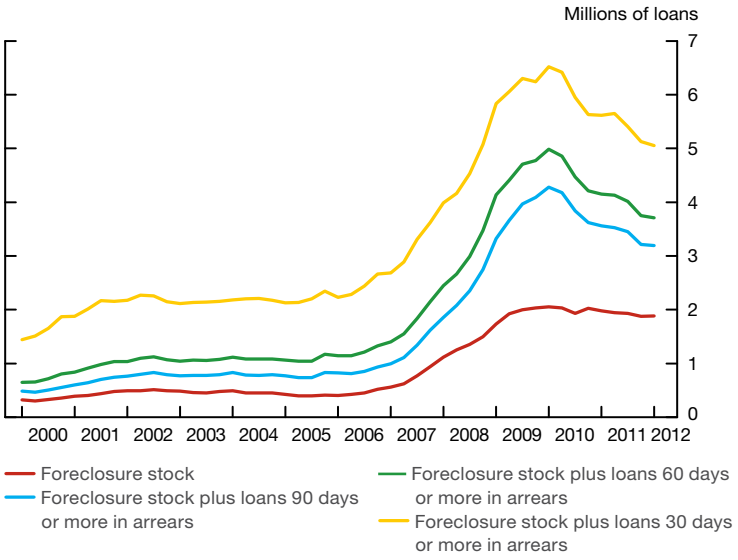
Comparison of maximum, minimum and median Tier 1 capital ratios of large U.S. banks as a percentage of risk-weighted assets (Basel I definition)



Note: The red boxes represent the median Tier 1 capital ratios. The vertical lines indicate the maximum and minimum Tier 1 capital ratios for a representative group of eight U.S. banks.

Source: Bloomberg Last observation: 2012Q1

Chart 13: Non-performing housing-related loans remain elevated at U.S. banks



Sources: Mortgage Bankers Association and Bank of Canada calculations Last observation: 2012Q1

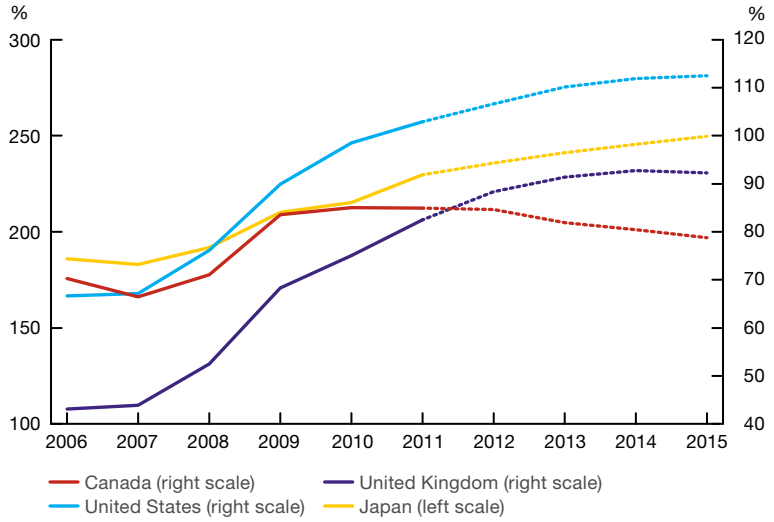
Fiscal consolidation in the United States and Japan is needed, but the pace and timing pose significant macroeconomic risks

The elevated levels of indebtedness in the major advanced economies, including the United States and Japan, are a significant source of vulnerability for the global economy. In a number of these countries, debt-to-GDP ratios are projected to rise further (**Chart 14**). According to IMF estimates, the gross financing needs of Japan and the United States in 2012 are close to or higher than the financing requirements estimated for stressed euro-area countries. Japan and the United States must make significant adjustments over the medium term to achieve debt sustainability (**Chart 15**).[16]

16 The IMF's *Fiscal Monitor* defines a sustainable debt-to-GDP ratio as 60 per cent for all economies except Japan. For Japan, this ratio is 80 per cent of GDP.

Chart 14: Fiscal positions are expected to remain strained in a number of advanced economies

General government gross debt as a percentage of nominal GDP



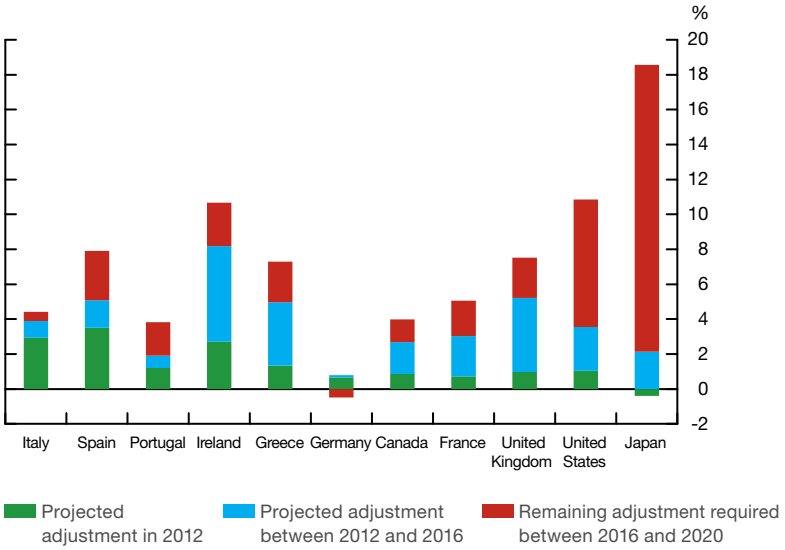
Notes: General government gross debt includes claims on all levels of government. Broken lines indicate IMF projections.

Source: IMF *Fiscal Monitor*, April 2012

Last data point plotted: 2015

Chart 15: Fiscal consolidation is proceeding, but much progress still to be made

Change in cyclically adjusted primary balances necessary to attain a target[a] debt-to-GDP ratio by 2030



a. Total adjustment required to reduce the gross debt-to-GDP ratio to 60 per cent by 2030 (net debt target of 80 per cent for Japan). After 2020, the primary balance must be maintained at the prevailing level until 2030.

Source: IMF *Fiscal Monitor*, April 2012

However, the timing and pace of these adjustments also represent a significant source of macroeconomic risk. In the United States, in particular, political stalemate is contributing to the uncertainty about the timing and scale of the near-term fiscal consolidation. A number of fiscal measures, including some tax cuts and extensions of unemployment insurance benefits, are set to expire in 2013, at the same time as the automatic spending cuts associated with sequestration are scheduled to be implemented. In

the Bank's economic outlook for the United States, a significant number of these temporary measures are assumed to expire and the sequestration cuts are fully implemented, resulting in an estimated fiscal drag on U.S. economic growth of about -2.5 percentage points in 2013.[17] However, if all temporary measures expire, the drag on growth due to the fiscal retrenchment in 2013—widely characterized as the "fiscal cliff"—could be much higher (around -4.0 percentage points), which would result in considerably weaker U.S. economic activity than is currently assumed.

Developments in emerging markets could weaken growth in advanced economies

Another downside risk concerns the possibility of a hard landing in the emerging-market economies which, since the financial crisis, have been the primary force behind global economic growth. In a number of these countries, growth has moderated recently, reflecting, in part, the effects of past policy tightening and the drop-off in export demand from Europe. Economic activity in China has recently been weaker than expected, while growth in Brazil has almost come to a standstill since the start of 2012. In addition, GDP growth in India in the first quarter was the weakest in a decade as stalled reform efforts added to the drag from declining exports due to the euro-area crisis. While in most cases the authorities have changed direction to provide policy stimulus, there is a risk that the slowdown in activity may be sharper than expected or intended. If this were to occur, growth in the major advanced economies would weaken as well.

A global economic slowdown could impair the credit quality of bank loan portfolios

Canadian banks have continued to consolidate their favoured status in the global banking community by boosting the level and quality of their capital, improving the stability of their funding and posting strong profits.

Despite this improvement, weaker growth in other advanced economies would affect the financial system in Canada through trade, confidence and financial channels. Trade linkages with affected regions would dampen economic activity in Canada, increase unemployment and reduce household spending, eventually leading to higher loan losses for financial institutions. This channel would be especially important if the United States (Canada's largest trading partner) were to experience a significant downturn. Weak market confidence would lead to a retreat of risk-taking. This could result in capital losses for Canadian banks and raise their funding costs. These developments could then lead to an increased cost of loans and tighter lending conditions for Canadian households and businesses, also creating an adverse feedback loop between the decline in economic activity and stress in the financial system.

Canadian Household Finances and the Housing Market

The elevated level of household indebtedness continues to be the most important domestic risk to financial stability in Canada. There have been some welcome developments since the December FSR—notably, the pace of household debt accumulation has slowed and some vulnerability measures appear to be stabilizing. Nonetheless, vulnerabilities are entrenched for the most seriously at-risk households, and the Bank's stress-test simulations continue to suggest that households are vulnerable

17 See the Bank's April 2012 *Monetary Policy Report*, page 9.

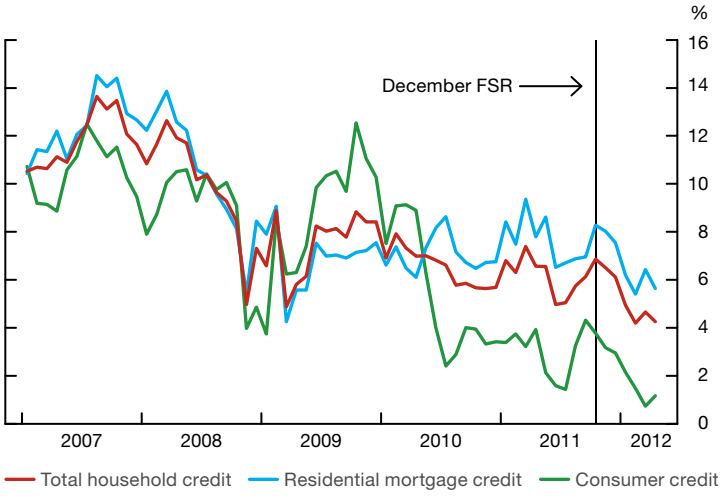
to adverse economic shocks. Moreover, the continued high level of activity and stretched valuations in some segments of the housing market are of increasing concern. Overall, the Governing Council judges that the risks associated with high levels of household debt and a potential correction in the housing market are elevated and have not diminished since December. A reduction in this domestic risk requires a combination of deleveraging by vulnerable households and a reduction in housing market imbalances.

The deterioration in household balance sheets has slowed...

Some of the recent data on household finances have been encouraging. The growth of debt has moderated since the December FSR: total household credit grew by about 6 per cent (at annualized rates) from May to October 2011 and by about 4 per cent from November 2011 to April 2012. The slowdown is evident in both mortgage and non-mortgage credit (**Chart 16**). The aggregate

Chart 16: The growth of household credit has moderated since the last FSR

Annualized 3-month growth rates

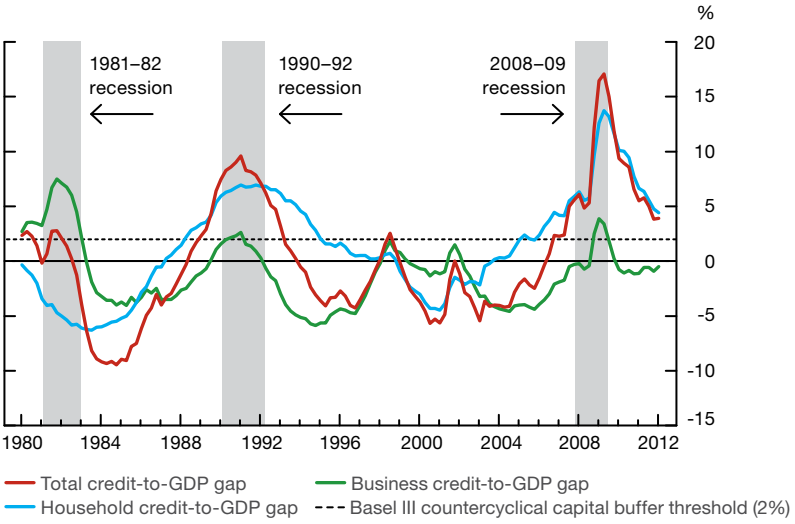


Source: Bank of Canada

Last observation: April 2012

Chart 17: The aggregate credit-to-GDP gap has declined but remains high

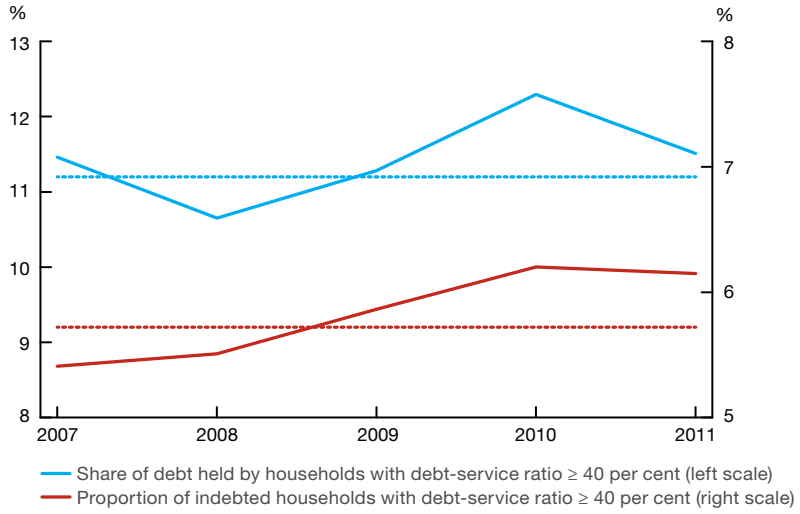
Percentage deviation from trend



Sources: Statistics Canada and Bank of Canada calculations

Last observation: 2012Q1

Chart 18: Vulnerability measures based on household microdata remain elevated



Note: Broken lines indicate historical average from 2002 to 2011.

Sources: Ipsos Reid and Bank of Canada calculations Last observation: 2011

credit-to-GDP gap for Canada continues to fall from its cyclical peak, largely because of the moderation in the growth of household debt in recent years (**Chart 17**). By historical standards, however, the gap is still high.[18]

Microdata on household finances show that the share of indebted households that have a debt-service ratio greater than or equal to 40 per cent[19] was largely stable between 2010 and 2011 (**Chart 18**), while the proportion of debt owed by these households decreased slightly in 2011. The popularity of fixed-rate mortgages has also risen noticeably over the past six months, indicating that some households are less sensitive to increases in interest rates than was previously the case. However, both the share of indebted households with a debt-service ratio equal to or higher than 40 per cent and the proportion of debt owed by these households have remained above their 2002–11 averages, despite record-low interest rates.

...but the financial situation of households remains strained

Although the pace of debt accumulation has moderated, the debt-to-income ratio of the Canadian household sector was virtually unchanged at its historical peak of 150.6 per cent in the fourth quarter of 2011, and is above the levels for both the U.S. and U.K. household sectors (**Chart 19**). Given the muted growth of household disposable income in the first quarter of 2012, it is likely that this ratio will rise further over the near term.

The slowdown in credit growth in recent months occurred despite strong activity in the housing market in the fourth quarter of 2011. Housing activity has also been robust thus far in 2012, boosted in part by competition in mortgage pricing by financial institutions. There is usually a lag of one to six months between the sale of a house and the reporting of the transaction in mortgage credit statistics.[20] This suggests that credit growth will increase in the coming months.

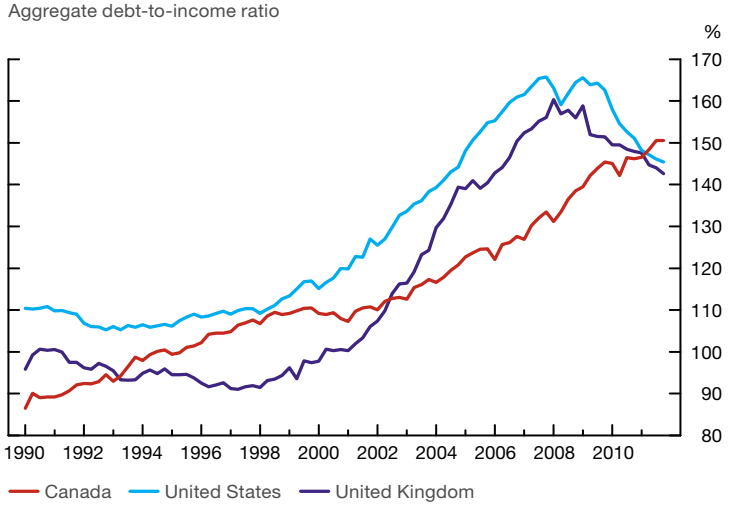
18 International evidence has shown that the credit-to-GDP gap is a useful guide for identifying a potential buildup of imbalances in the banking sector. This indicator has been proposed by the Bank for International Settlements as a guide for activating a countercyclical capital buffer. For more information on the construction of the credit-to-GDP gap, and its relevance, see Box 3 on page 22 of the June 2011 FSR.

19 Consistent with industry standards, a household is considered to be more likely to have difficulty making loan payments when its debt-service ratio is 40 per cent or higher.

20 The lag corresponds to the time period between the finalization of the sale and when the homeowner takes possession of the unit.

Chart 19: Canadians are now more indebted than the Americans or the British

Aggregate debt-to-income ratio

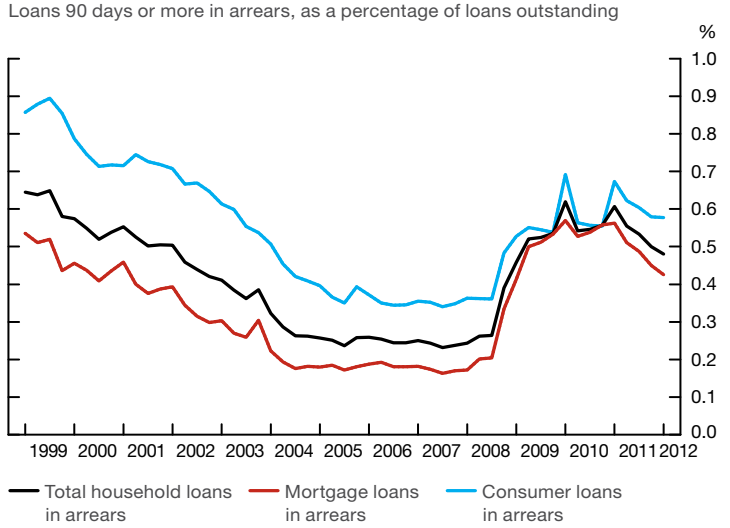


Sources: Statistics Canada, U.S. Federal Reserve and U.K. Office for National Statistics

Last observation: 2011Q4

Chart 20: Household loans in arrears remain elevated

Loans 90 days or more in arrears, as a percentage of loans outstanding



Source: Regulatory filings of Canadian banks

Last observation: 2012Q1

Over a longer horizon, the underlying trend in credit growth is expected to moderate gradually to a pace closer to that of income growth, as housing activity moves back in line with demographic demand. However, since the difference between credit and income growth is expected to remain positive, further increases in the aggregate household debt-to-income ratio are likely over the medium term.

Indicators of financial distress in the household sector, such as mortgage and consumer loan arrears, have eased somewhat since the December FSR but remain elevated despite low interest rates and improving labour market conditions (**Chart 20**).

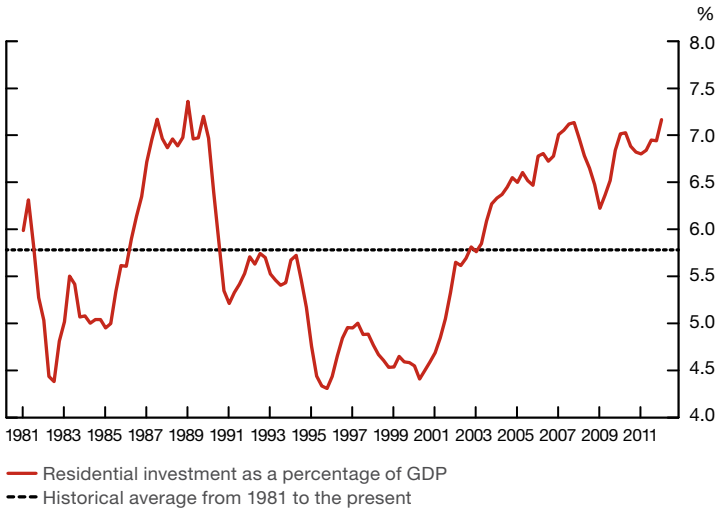
Even with the recent shift in preference toward fixed-rate loans, households remain exposed to interest rate risk. According to Bank estimates, under a hypothetical scenario where the policy rate rises by 325 basis points by mid-2015 and households do not proactively manage their exposures to

interest rate variability,[21] the proportion of total household sector debt held by households with a debt-service ratio equal to or above 40 per cent would rise from 11.5 per cent in 2011 to roughly 20 per cent by 2016. This would heighten the sensitivity of the household sector to adverse shocks.

Strong housing activity is leading to increasingly unbalanced economic growth

Since the December FSR, both activity in the housing market and the growth of house prices have been firmer than anticipated. In fact, the Bank had expected the share of nominal residential investment in GDP to start declining toward its historical average. This has yet to occur, because of the strong growth in residential investment over recent quarters (**Chart 21**). Housing starts have increased since December, while sales of existing homes have also remained high. The momentum in the growth of house prices has also risen since the last FSR (**Chart 22**), and prices are currently about 14 per cent higher than the pre-crisis level recorded in December

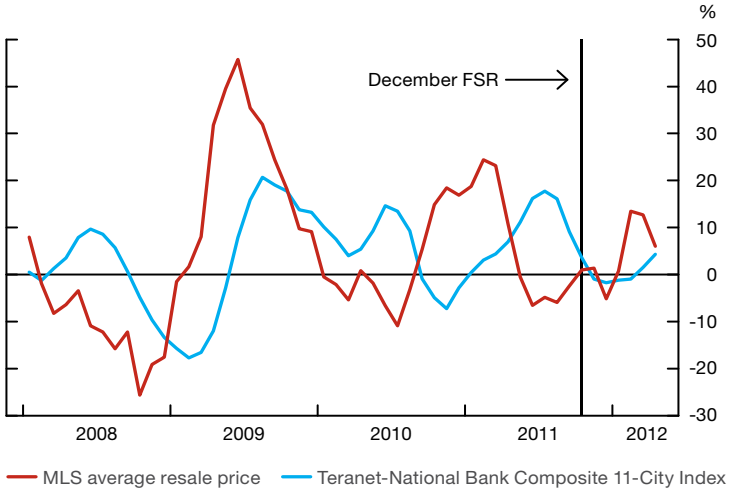
Chart 21: Share of residential investment in GDP is well above its historical average



Sources: Statistics Canada and Bank of Canada calculations — Last observation: 2012Q1

Chart 22: House-price growth has picked up since the last FSR

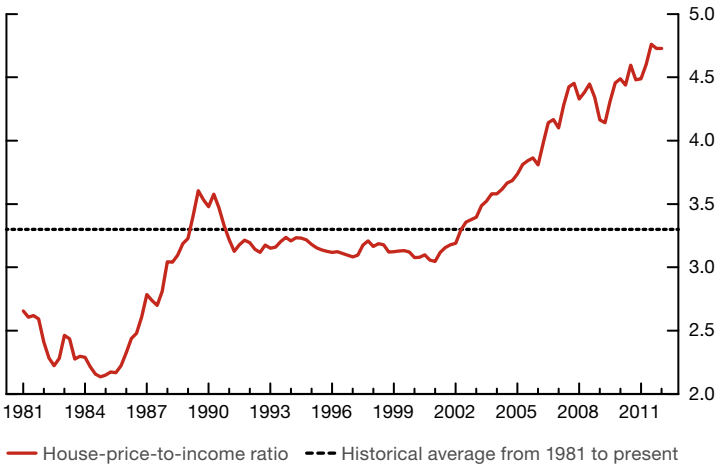
Annualized 3-month growth rate



Sources: Canadian Real Estate Association and Teranet-National Bank — Last observation: April 2012

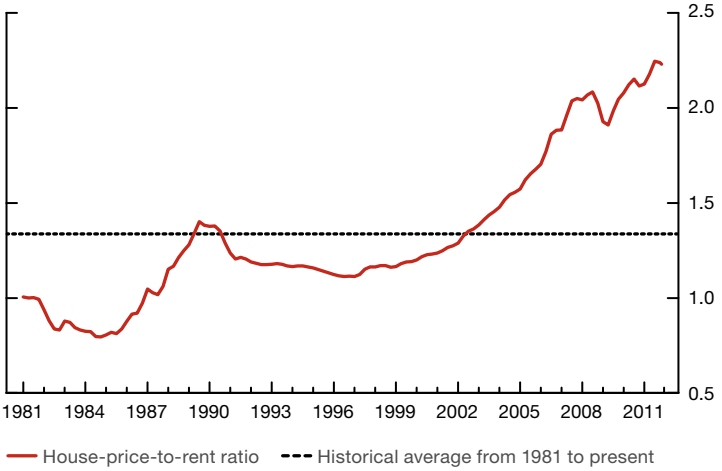
21 For example, it is assumed that households that have variable-rate loans do not switch to fixed rates.

Chart 23: House prices in Canada are still high relative to disposable income



Sources: Teranet-National Bank, Statistics Canada, Canadian Real Estate Association and Bank of Canada calculations
Last observation: 2012Q1

Chart 24: The ratio of house prices to rent is significantly higher than its historical average



Sources: Teranet-National Bank, Statistics Canada, Canadian Real Estate Association and Bank of Canada calculations
Last observation: 2012Q1

2007.[22] Measures of housing affordability are broadly unchanged since the December FSR and suggest some overvaluation: house prices are high relative to both income (**Chart 23**) and rent (**Chart 24**), and housing affordability could become a concern as interest rates start to normalize (**Chart 25**).

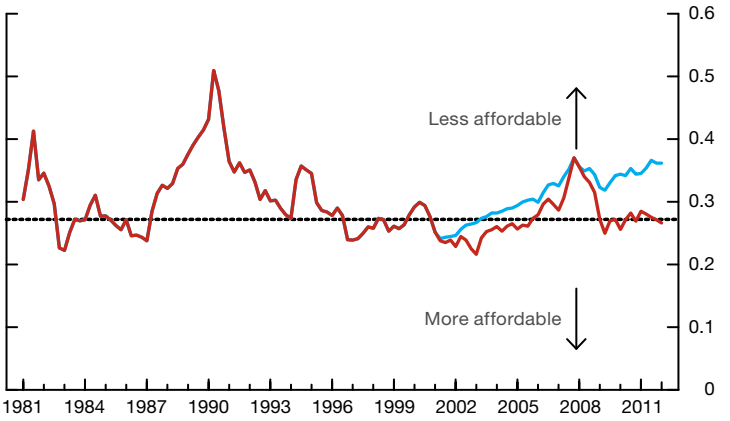
Households are vulnerable to adverse economic shocks

Canadian households are vulnerable to two interrelated shocks: a significant decline in house prices and a sharp deterioration in labour market conditions. These shocks would be especially disruptive for households with high levels of indebtedness.

Housing assets have become increasingly important for the net worth of Canadian households, currently accounting for about 40 per cent of their total assets, up from 34 per cent 10 years ago. Market segments that have a

22 Based on Multiple Listing Service average home resale prices

Chart 25: Housing affordability could decline significantly if interest rates were closer to historical norms



a. This measure estimates the size of mortgage payments for a representative first-time homebuyer given prevailing interest rates and house prices, and then scales this value by personal disposable income in order to measure affordability.

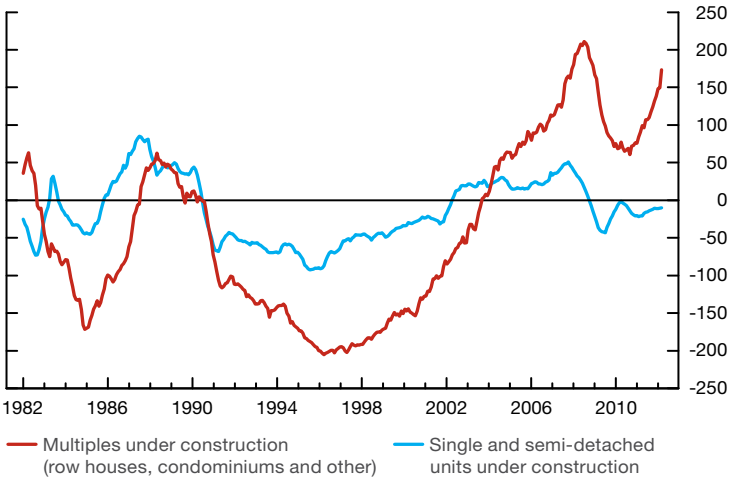
b. To illustrate affordability if interest rates were closer to historical norms, the average real mortgage rate from 1996 on (4 per cent) is used to set a floor for the real interest rate; if the observed value is below 4 per cent in a period, the floor is used in the calculation.

Sources: Teranet-National Bank, Statistics Canada, Canadian Real Estate Association and Bank of Canada calculations

Last observation: 2012Q1

Chart 26: The supply of multiple-unit dwellings under construction is significantly above its historical average

Adjusted for population aged 25 years+, deviation from historical average, per 100,000 people; major metropolitan areas



Sources: Canada Mortgage and Housing Corporation, Statistics Canada, and Bank of Canada calculations

Last observation: April 2012

persistent oversupply of housing units face a higher risk of price declines.[23] The elevated supply of condominiums and other multiple dwellings entering the market over the next few years is particularly noteworthy. Adjusted for population levels, multiples under construction in major metropolitan areas, especially Toronto, are above historical highs (**Chart 26**). If these units are

23 The experience of the Calgary condominium market around the time of the 2008 financial crisis highlights the risks of overbuilding. In Calgary, the construction of multiple-unit dwellings (largely condominiums) peaked in 2008. This was followed by a significant increase in unsold inventory, and condominiums experienced a cumulative price decline of 20 per cent between 2007 and 2010.

not absorbed by demand as they are completed over the next 18 to 36 months, the demand-supply imbalance will become more pronounced. Since strong investor demand has spurred levels of construction that are above demographic-based demand, this market will be susceptible to changes in buyer sentiment.

Price corrections in important segments of the housing market can have adverse effects on the financial system through contagion, which could arise, for example, from a retrenchment in market confidence or a reduction in the availability of credit as financial institutions come under increased stress. The initial decrease in house prices may be amplified by the links with the real sectors of the economy as lower confidence and lower household net worth lead to reduced household spending and employment. These interrelated factors would reduce economic activity and increase strains on household balance sheets.

A sharp and persistent rise in the unemployment rate would reduce aggregate income growth, making it more difficult for some households to meet their debt payments. The resulting increase in loan-loss provisions for financial institutions[24] and the reduced quality of the remaining loans would lead to tighter credit conditions and, in turn, to mutually reinforcing declines in real activity and in the overall health of the financial sector.

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

The Bank has updated the household stress test reported in the December 2011 FSR to assess the potential impact of an adverse labour market shock on the financial situation of Canadian households and the banking sector. The stress test illustrates that a negative labour market shock would have a significant effect on loans in arrears.[25]

The debt-service ratio for each household is simulated conditional on assumptions about the future pace of debt accumulation, the level of interest rates, income growth and employment status. The model provides estimates of the share of household loans in arrears for three months or more in each simulation period.[26]

The shock scenario entails a 3-percentage-point rise in the unemployment rate and a six-week increase in the average duration of unemployment from current levels (**Table 2**). The shocks to the unemployment rate and to the duration of unemployment are calibrated to broadly replicate those experienced in Canada during the recession of the early 1990s. The shock scenario also includes corresponding declines in credit growth, income growth and financial asset prices, as well as a 220-basis-point increase in risk premiums for household borrowing. The policy rate is held constant to illustrate what would happen in the absence of mitigating policy action.

When subjected to a persistent unemployment shock that reaches its peak in 2013, the proportion of household loans in arrears at domestic financial institutions is projected to rise to 1.3 per cent, compared with roughly

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24 Household loans currently make up about 75 per cent of total domestic loans for banks, having increased from around 66 per cent in early 2006.

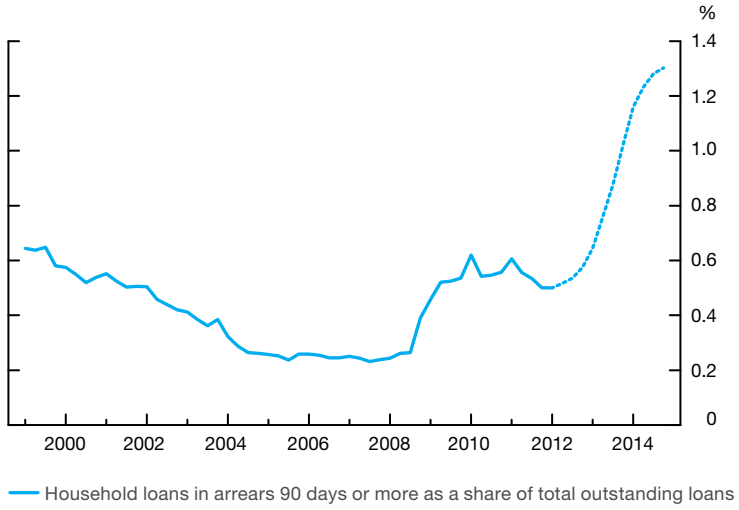
25 A new version of the model is used for this exercise. See "An Improved Framework for Assessing the Risks Arising from Elevated Household Debt" on page 51 of this issue of the FSR.

26 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 cash, bonds, stocks and mutual funds.

Table 2: Main shock scenario assumptions

	Credit and income (quarter-over-quarter annualized growth, per cent)		Interest rates (basis points)		Unemployment (per cent)
	Growth of total household credit	Growth of disposable income	Overnight rate	Effective household borrowing rate	Rate
2012Q1	4.7	1.1	100	493	7.4
2012Q2	5.3	3.8	100	477	7.4
2012Q3	5.3	3.8	100	462	7.4
2012Q4	1.0	0.0	100	497	8.2
2013Q1	1.0	0.0	100	533	8.9
2013Q2	1.0	0.0	100	569	9.7
2013Q3	1.0	0.0	100	607	10.4
2013Q4	2.5	2.0	100	609	10.4
2014Q1	2.5	2.0	100	611	10.4
2014Q2	2.5	2.0	100	613	10.4
2014Q3	2.5	2.0	100	614	10.4
2014Q4	2.5	2.0	100	616	10.4

Chart 27: Household loans in arrears would more than double in a scenario where unemployment rises by 3 percentage points



Note: Broken line indicates stress-test result.
Sources: Regulatory filings of Canadian banks and Bank of Canada calculations

Last data point plotted: 2014Q4

0.5 per cent in the fourth quarter of 2011 (**Chart 27**).[27] These results are in line with those from the exercise reported in the December FSR, suggesting that the risk from household finances is broadly unchanged.

Since a number of simplifying assumptions were necessary to conduct the simulation, the results indicate possible outcomes only and do not represent a comprehensive assessment of all possible risk channels. Although the shock scenario aims to capture a range of risk factors that are likely to coincide, such as an increase in unemployment, low income growth and higher risk premiums, it does not reflect other types of losses (such as those on business loans and the trading book) that banks would incur in this

27 In a control scenario with a stable unemployment rate, the proportion of household loans in arrears would stay near current levels over the simulation period.

setting. Other features of the model may cause the results to overstate the rise in the arrears rate.[28] Nevertheless, the results underscore the need for banks to carefully consider the aggregate risk of their household exposures. In addition, households need to assess their ability to service their debt over the entire maturity of their loans, especially as borrowing rates return to a more normal level. The Bank is co-operating closely with other federal authorities to continuously assess the risks arising from the financial situation of the household sector.

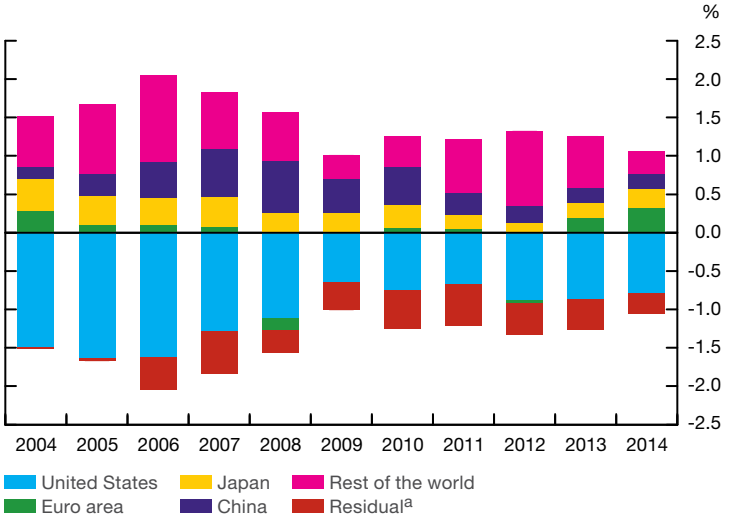
Global Imbalances

While global current account imbalances have declined slightly and are expected to narrow further through 2014 (**Chart 28**), they continue to represent an important risk to the global financial system. The asymmetric adjustment process through which the imbalances are resolving themselves is a matter of concern. Current account imbalances are narrowing largely because of deficient demand for imports in advanced economies due to contractionary fiscal policies and household deleveraging. This in turn is leading to weak demand for exports from surplus countries and lower global economic growth. Moreover, real exchange rate adjustment between the United States and China is taking place primarily through higher inflation in China, rather than through increased nominal exchange rate flexibility.

A more balanced resolution of current account imbalances that would support global economic growth is required. Such an adjustment necessitates structural reforms and greater nominal exchange rate flexibility for surplus countries in order to induce further rotation of demand away from exports and toward domestic demand in China and other emerging markets of Asia.

Chart 28: Global current account imbalances are expected to decrease somewhat through 2014

Current account balance as a percentage of global GDP



a. The residuals over history and over the projection period are compiled by the International Monetary Fund.

Sources: IMF *World Economic Outlook*, April 2012 and Bank of Canada projections

Last data point plotted: 2014

28 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, the model does not allow households to avoid insolvency by selling less-liquid assets.

Without a more profound rotation of demand, weaker global economic growth will likely persist and raise the risk, albeit a small risk, of deflation in some advanced economies.

While there has been some progress in implementing the G-20 commitments to achieve a more sustainable path for global economic growth, implementation is likely to fall short of the announced commitments in the near term. Overall, the risks of a disorderly adjustment of global imbalances with adverse impacts on financial stability are elevated but are judged to have declined since December.

Some progress has been made in meeting the targets set out in the G-20's action plan for "Strong, Sustainable and Balanced Growth"

In 2009, the G-20 set out a road map to track the progress in reducing global imbalances.[29] This plan included measurable fiscal and exchange rate commitments, as well as structural reforms. Some progress has been made in a number of areas, although many key countries may not fully meet their near-term commitments.

As part of their pledges at the Toronto G-20 Summit in 2010, advanced economies committed to cutting their 2010 budget deficits in half by 2013 and stabilizing their debt-to-GDP ratios by 2016. These pledges reflect the necessity to strike a careful balance between the need to achieve debt sustainability and the risk that overly aggressive fiscal consolidation may have a detrimental impact on growth. The United States and the United Kingdom in particular will have to take further substantive fiscal actions in order to meet their 2013 targets (**Table 3**).

On a real-effective basis, the Chinese renminbi (RMB) has appreciated by roughly 6 per cent since the summer of 2011. While additional appreciation is required to address current account imbalances, this development indicates that some progress has been made. The Bank's projection of declining current account imbalances (**Chart 28**) is partly predicated on a further real appreciation of the RMB by 2014. The new wider trading band for the RMB announced on 14 April is a welcome development, but so far it has not resulted in any noticeable change in the actual behaviour of the exchange rate, and it remains to be seen whether any meaningful increase in flexibility will result.[30] Other measures, such as China developing its money market by allowing the use of reverse repo transactions, are also a positive step since they help to provide the financial infrastructure that is necessary for a well-functioning flexible exchange rate regime.

One of the important goals for structural reform agreed upon by the G-20 was for surplus countries such as Germany, Japan and China to promote stronger domestic demand and rotate away from externally led growth. While it is difficult to assess the impact of these reforms, partly because of the long implementation lags, there appears to have been only limited progress on this front since December. Domestic demand as a share of GDP has remained roughly stable for key surplus economies.

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29 "G-20 Leaders Statement: The Pittsburgh Summit—A Framework for Strong, Sustainable, and Balanced Growth." Available at <http://www.g20.utoronto.ca/2009/2009communique0925.html>.

30 The People's Bank of China will continue to fix parity to an unspecified basket of currencies and has not indicated whether its daily fixings will be predicated on movement within the band. In fact, the RMB has seldom come close to testing the limits of the previous narrower band. In the five years since May 2007, the intraday exchange rate for the RMB never hit the lower bound, and the upper bound was reached only 19 times.

Table 3: Fiscal balances (as a percentage of GDP)

	2011	IMF projection for 2012	IMF projection for 2013	Toronto Summit commitment for 2013[a]	Gap[b] (percentage points)
Australia	-4.3	-2.5	-0.6	-2.5	0.0
Canada	-4.5	-3.7	-2.9	-2.8	0.1
France	-5.3	-4.6	-3.9	-3.6	0.3
Germany	-1.0	-0.8	-0.6	-2.2	0.0
Italy	-3.9	-2.4	-1.5	-2.3	0.0
Japan	-10.1	-10.0	-8.7	-4.7	4.0[c]
United Kingdom	-8.7	-8.0	-6.6	-5.0	1.6
United States	-9.6	-8.1	-6.3	-5.3	1.0
Euro area	-4.1	-3.2	-2.7	-3.2	0.0

a. Countries committed to halving fiscal deficits by 2013

b. Difference between commitment for 2013 and IMF forecast for 2013. The difference is depicted as zero for negative values (i.e., the commitment is met or exceeded).

c. Japan was exempted from the Toronto commitment.

Source: IMF *Fiscal Monitor*, April 2012

Lack of symmetric adjustment creates pressure points in the financial system

The insufficient broad-based adjustment by countries with current account surpluses continues to place an asymmetric burden on deficit countries with more flexible exchange rates. Delays in implementing structural adjustments, as well as the lack of exchange rate flexibility, can lead to significant distortions in the global economy. Moreover, with a fixed exchange rate, real exchange rate adjustment in surplus countries can take place only through higher inflation. While this has, to some extent, been occurring in a number of countries, notably in China, the authorities have sought to contain inflation through the sterilization of currency interventions, a policy that is fiscally costly, introduces considerable financial system distortions and is ineffective over the long run.[31] There is a risk that the disparity in adjustment could lead to mounting political tensions and result in retaliatory policy actions, which would be counterproductive to global economic growth and prosperity.

The lack of adjustment has led to sizable imbalances in selected domestic economies and could foster overinvestment and asset bubbles. Should a boom-bust scenario materialize in the Chinese property market, for instance, with an ensuing significant drop in economic growth, the impact on the financial system could be material. In addition, even though the risk of deflation in advanced economies has diminished, such an outcome would increase real debt burdens and result in considerable additional stress on their financial systems.

The crystallization of these macroeconomic factors would have significant repercussions on the financial system. As a result, it is imperative that the G-20 commitments be implemented in a timely manner and aligned with improving the prospects for global economic growth.

Low Interest Rate Environment in Major Advanced Economies

Another important source of risk in the global financial system is the prolonged period of low interest rates in a number of advanced economies that have been at or near historically low levels since the 2008 global financial crisis. Previous episodes of unusually low interest rates have frequently been associated with the buildup of imbalances and vulnerabilities in the financial

31 In a successful sterilization operation, the domestic component of the monetary base (bank reserves plus currency) is reduced to offset the inflow of reserves, at least temporarily. The classic form of sterilization uses central bank open-market operations.

system, including the misallocation of credit and the mispricing of risk. While such imbalances are usually difficult to identify before the associated risks have materialized, the current situation calls for heightened vigilance.

In most advanced economies, the current low level of interest rates partly reflects the monetary policy response to protracted economic weakness in the wake of the financial crisis. Indeed, in recent months, a number of central banks, including the U.S. Federal Reserve, the Bank of England and the Bank of Japan, have reinforced their accommodative monetary stance, including through exceptional operations designed to bring down long-term yields.

This environment creates incentives that may lead to significant vulnerabilities. It puts pressure on the balance sheets of institutional investors that hold long-duration liabilities, such as life insurance companies and defined-benefit pension plans. It also increases the incentive for investors to search for higher returns, including by taking on duration mismatches and by investing in asset classes or strategies for which they may not fully appreciate all of the associated risks. These two dimensions of risk are related, since the drive for yield is more intense for institutions facing balance-sheet pressures.

Given the nature of the vulnerabilities that may be involved—in many cases, seemingly prudent investment strategies that may involve hidden risks—it is difficult to track the evolution of this risk. Since the balance sheets of pension funds and life insurance companies remain quite stressed, and since risk in the financial system can manifest itself in new ways that may be difficult to detect or quantify on a timely basis, vigilance is required. Taken as a whole, the risks to financial stability from an extended period of low interest rates are judged to be moderate and are broadly unchanged since December.

Given the macrofinancial context, interest rates may remain low for a longer period in a number of advanced economies

Central banks in most advanced economies have either eased monetary conditions or maintained their current accommodative stance since the December FSR.

In January, the U.S. Federal Reserve indicated that it would conditionally keep the federal funds rate at an exceptionally low level, at least through late 2014—approximately one-and-a-half years longer than its prior conditional commitment. This stance was reiterated in the Federal Reserve's March and April FOMC statements. Meanwhile, the Bank of England raised its total planned purchases of gilts by £50 billion to £325 billion in February, and the Bank of Japan increased the size of its asset-purchase program from ¥55 trillion to ¥65 trillion in February and to ¥70 trillion in April 2012. The Bank of Japan has also extended the maturity of its remaining bond purchases by one year to encourage a decline in longer-term interest rates.

These developments have reinforced market expectations that interest rates in some advanced economies will remain low for a longer period than previously anticipated. For the United States, for example, market expectations of an increase in the policy rate have been pushed back from March 2014 at the time of the last FSR to December 2014.[32] There has also been some further flattening of the yield curve in the United States, the United Kingdom and Canada since December (**Chart 29**).[33]

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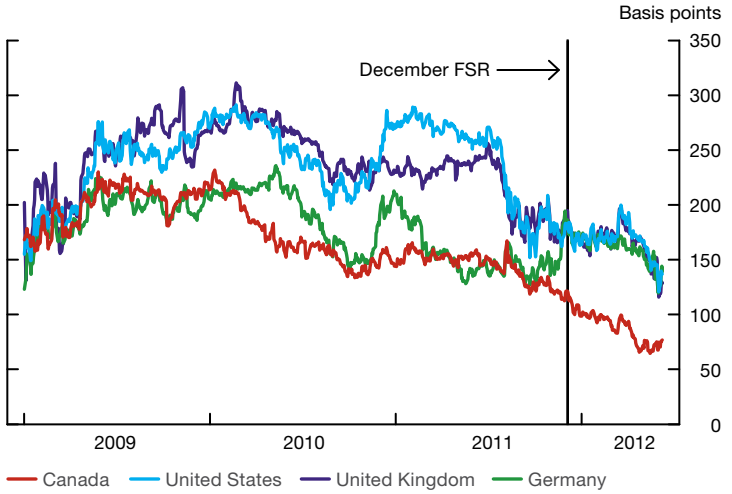
32 In Canada, markets now expect the policy rate to remain near the current level over the next year, compared with expectations in December of a decline in the policy rate one year out.

33 Yields on 10-year sovereign bonds in these countries are currently near historic lows.

Chart 29: Yield curves have flattened further since the December FSR

Yields on 10-year sovereign bonds minus yields on 2-year sovereign bonds



Source: Bloomberg

Last observation: 8 June 2012

Low interest rates will continue to present challenges to some financial institutions

Financial institutions with long-duration liabilities such as life insurance companies and defined-benefit pension plans could face balance-sheet pressures in a prolonged low interest rate environment. The actuarial value of contractual liabilities increases with lower interest rates, while at the same time, returns on safer (lower-yielding) assets fall or remain too low to meet the targeted returns necessary to satisfy the minimum-return guarantees offered to policyholders and beneficiaries. If such tensions persist, these institutions will face pressures to push their traditional boundaries of risk-taking in search of higher returns.

In particular, the profitability of global life insurance and pension fund industries has decreased, leaving them more vulnerable to other adverse shocks. Life insurers, some of which relied heavily on variable annuity products for revenues before the crisis, have been especially affected by the decline in interest rates in recent years. While the profitability of the Canadian life insurance sector has improved somewhat since the December FSR, this shift was partly the result of improvements in global equity markets in the first quarter of 2012, which have since been reversed. With expectations that interest rates may stay lower for a longer period of time, insurance companies will have to continue to reduce their ultimate reinvestment rates to adhere to accounting rules, putting pressure on profits and capital.

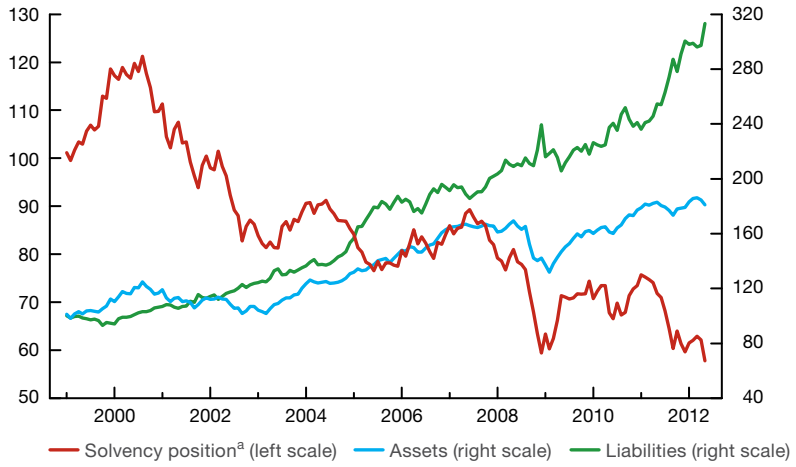
Canadian pension funds have also been under stress. According to Mercer's Pension Health Index, the solvency position[34] of a representative Canadian pension plan was at an all-time low in May (**Chart 30**). Survey data suggest that 20 per cent of pension funds are proactively managing the challenges posed by the low interest rate environment by using sophisticated liability-driven investment (LDI) strategies.[35] These strategies are intended to reduce their sensitivity to an unexpected change in interest rates and

34 Solvency position is defined as assets divided by liabilities. A decline in the index indicates that a representative pension plan faces a higher risk of being unable to fully meet its financial obligations.

35 Greenwich Associates, "Canadian Pensions: A Heightened Focus on Liabilities," 13 February 2012.

Chart 30: The solvency position of defined-benefit pension funds in Canada is at an all-time low

Indexes (December 1998 = 100)



a. Solvency position is equal to assets divided by liabilities.

Source: Mercer (Canada) Limited

Last observation: May 2012

achieve a better matching of assets and liabilities for the funds. Unlike traditional liability-matching investments, however, LDI strategies (and similar approaches such as long-short fixed-income strategies) generally increase financial leverage through derivatives or repurchase agreements with a view to increasing investment returns. This exposes pension funds to new sources of risk, which they may not fully appreciate or be positioned to manage adequately.[36]

There has been limited evidence of excessive risk-taking so far

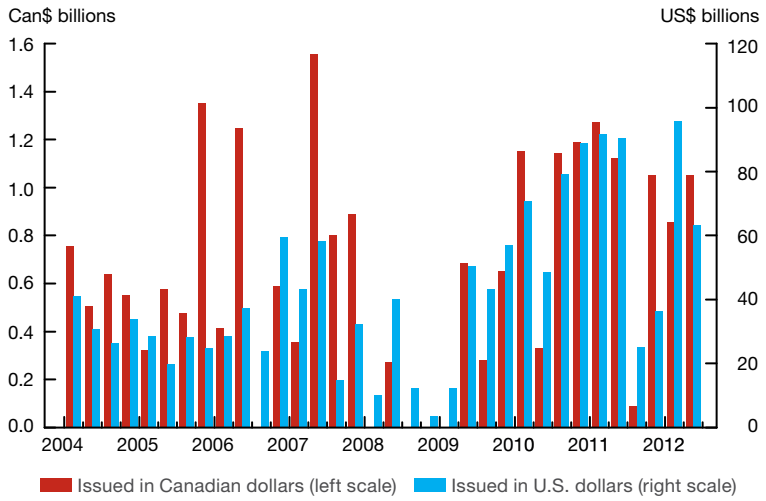
While the incentives for excessive risk-taking have strengthened, there has been limited evidence of a resurgence of risky behaviour since the December FSR. Activity in the high-yield securities market has mirrored the general investor sentiment over the past six months: a return of risk tolerance over the first quarter of 2012 from unusually low levels in December, and the re-emergence of risk aversion in recent months. Issuance of U.S.-dollar-denominated high-yield securities rose at a very rapid pace in the first quarter of 2012 but has slowed noticeably since then (**Chart 31**). Similarly, credit spreads on non-investment-grade securities have moved higher recently after narrowing over the first quarter (**Chart 32**).[37] Higher-risk products such as "covenant-lite" loans have not gained much traction since December.

A consequence of the low interest rate environment in advanced economies has been an increased interest in higher-risk asset classes such as commodities and emerging-economy capital markets. Both of these market segments have seen strong, albeit uneven, capital inflows in recent years. Although misalignments in asset prices are difficult to detect, there are no signs at this

36 For example, if long-term bond positions are funded with short-term repurchase agreements, the fund is exposed to rollover risk and possibly forced liquidation of other assets should this source of funding disappear. Also, if interest rate swaps are used to extend the duration of plan assets, the fund is exposed to long-term counterparty credit risk and possibly also to basis risk if swap rates and the interest rates to which the fund liabilities are exposed do not move in a similar manner over the investment horizon.

37 Credit spreads are measured relative to the yields on sovereign debt.

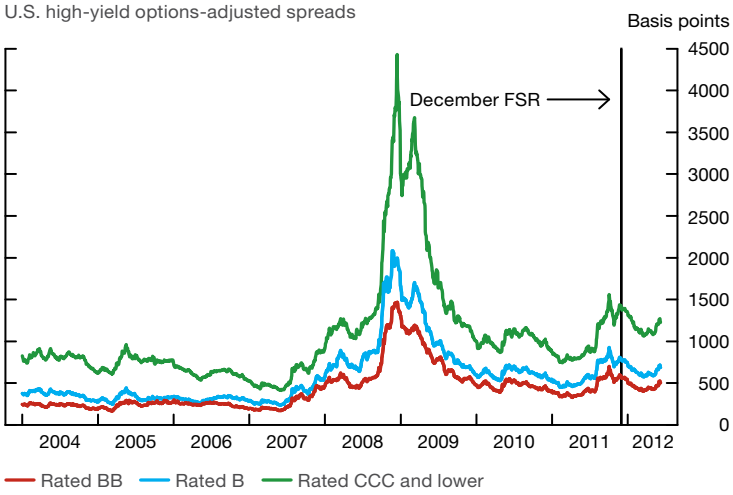
Chart 31: The issuance of U.S.-dollar-denominated high-yield corporate securities was strong in 2012Q1, but has recently moderated



Note: 2012Q2 numbers are estimated based on data for April and May.
Sources: Bloomberg and Bank of Canada calculations
Last observation: 2012Q2

Chart 32: Spreads on U.S.-dollar-denominated non-investment-grade securities are lower since December

U.S. high-yield options-adjusted spreads



Sources: Bloomberg and Bank of America Merrill Lynch
Last observation: 8 June 2012

point that current valuations in core commodities and emerging capital markets are significantly out of line. For example, the price-earnings ratio for the MSCI Emerging Markets Index is currently well below its historical average.[38]

Policy-makers need to closely monitor changes in investors' risk-taking behaviour and business strategies

A prolonged period of low interest rates can breed vulnerabilities in the financial system if financial institutions such as life insurance companies and pension funds fail to adjust their business models. As financial entities

38 The MSCI Emerging Markets Index is a free-float-adjusted market capitalization index designed to measure equity-market performance in global emerging markets. The current value of the price-earnings ratio for the MSCI Emerging Markets Index is 11, compared with an average of 16 since 1995. A higher-than-average level for this ratio could indicate a potential overvaluation.

adjust their behaviour to the current low-rate environment, they need to fully understand the credit and interest rate risks they face over the entire horizon of their investments.

Complacency about the persistence of low interest rates is a cause for concern. As the economic outlook improves, interest rates in the major advanced economies will return to more normal levels. Failure to factor this eventuality fully into business and investment strategies would lead to losses for some investors. In addition, significant volatility and losses may also result if investors try to exit from some asset classes en masse in response to a change in perception about the interest rate environment.

Policy-makers need to continue to closely monitor risk-taking behaviour in financial markets (including those related to financial innovation) to identify the early emergence of excessive concentrations of risk and to mitigate their potentially destabilizing consequences in a timely manner.

Safeguarding Financial Stability

While the financial system in Canada is in good condition, the Governing Council judges that the overall level of risk to the system remains high. Concerns arise from the combination of sovereign debt strains in Europe, downside risks to the economic outlook in other advanced economies, persistent global imbalances, the potential effects of low interest rates on risk-taking in the major advanced economies, and the vulnerability of Canadian households to adverse house-price and labour market shocks.

This issue of the FSR outlines a number of policy priorities that would help to mitigate these risks. Over the near term, the re-emergent threat from sovereign debt stress in the euro area calls for a robust and decisive policy response: that response needs to be perceived as *more* than adequate if it is to reverse the deterioration in market confidence. Euro-area banks need to be adequately and transparently capitalized. The reinforcement of the financial firewalls (EFSF/ESM) and increased operability of the mechanisms will also help to insulate other euro-area countries from the effects of contagion from Greece. Actions need to be taken by both deficit and surplus countries to address the underlying balance-of-payments imbalances in the euro area. This includes structural and product market reforms that reduce rigidities and facilitate adjustments in relative wages within the euro area. In addition, there also needs to be a clearer and more concrete framework for risk mutualization, supported by strengthened governance arrangements within the European monetary union. Ongoing discussions about deepening the union, if fully developed, would help address Europe's problems.

Adherence to the G-20 commitments to promote an orderly, timely and sustained resolution of global imbalances will help to foster balanced global economic growth. Market-oriented exchange rates that reflect underlying economic fundamentals are needed to facilitate this adjustment and strengthen the resilience of economies to shocks. Surplus economies must also undertake reforms to bolster self-sustaining domestic sources of growth—thereby reducing their reliance on external demand. Without these developments, there will be an increasing likelihood that a disproportionate amount of the necessary global adjustment takes place through deleveraging in deficit countries, further dampening global economic growth.

In Canada, the financial position of the household sector and elevated valuations in the housing market require vigilance. Household borrowing rates are exceptionally low but will eventually normalize to a higher level. For that

reason, households need to ensure that they will be able to service new and existing debt over the duration of their loans. For their part, financial institutions need to ensure that they have rigorous lending practices in place and are actively monitoring their risks, in line with OSFI's proposed guidelines for mortgage underwriting. Authorities in Canada will continue to closely monitor the financial situation of the household sector and developments in the housing market.

The timely implementation of the regulatory reform agenda established by G-20 leaders is essential and must remain a key priority. The risks and challenges highlighted in this FSR underscore the urgent need to make the financial system more resilient, notably through stronger capital, financial market infrastructure and resolution frameworks.

With regard to capital, while most aspects of the Basel III rules have been finalized, the new regulations need to be comprehensively and consistently applied across major financial jurisdictions. Canadian banks, along with banks in some other jurisdictions, plan to implement the Basel III rules in 2013, the first year of the agreed-upon phase-in period. This will reinforce the favoured position of Canadian financial institutions and provide additional buffers against potential shocks.

Establishing stronger market infrastructure that would be resilient in times of stress is an important priority to reduce the likelihood and consequences of future periods of financial system turmoil. A very important step in this direction is the launch in Canada of the new central counterparty service for the fixed-income repo market. A report describing its development is included in this issue of the FSR on page 43. Progress has also been made toward reducing systemic risk and improving transparency in over-the-counter derivatives markets. International standards and policy work to support reform in this market are largely complete, and efforts are well advanced in implementing safeguards to strengthen the safety of global clearing infrastructure. Financial stability also requires that credible frameworks for resolution are in place so that all banks, even those that are large and complex, can be resolved in a timely and orderly manner. A report that highlights the important progress made by the FSB in resolving systemically important financial institutions is included on page 37.

Reports

Reports examine selected issues of relevance to the financial system.

Introduction

This section of the *Financial System Review* includes three reports on topics related to the financial system: international work on ways to achieve better resolution of systemically important financial institutions; the development of the new central counterparty service for Canadian fixed-income markets; and improvements to the framework used at the Bank to assess risks from household indebtedness.

In **The Resolution of Systemically Important Financial Institutions**, Alexandra Lai and Adi Mordel explain the need for a special resolution regime for systemically important financial institutions (SIFIs). Using insights from the failure of Lehman Brothers, the authors discuss the main elements required for a well-defined resolution regime: appropriate scope to resolve all SIFIs, pre-crisis planning, ability to provide liquidity support and, since most SIFIs operate across several jurisdictions, cross-border coordination. The authors outline how the "Key Attributes of Effective Resolution Regimes for Financial Institutions" established by the Financial Stability Board in November 2011 address important challenges and stress the critical importance of consistent international implementation of the Key Attributes.

The report **Reducing Systemic Risk: Canada's New Central Counterparty for the Fixed-Income Market** discusses the new central counterparty (CCP) service for the fixed-income market in Canada. The new CCP is part of the Canadian Derivatives Clearing Service (CDCS), and is operated by the Canadian Derivatives Clearing Corporation. Authors Pothik Chatterjee, Lana Embree and Peter Youngman draw on the lessons of the financial crisis to demonstrate why a fixed-income CCP is necessary in Canada and describe how the new service works, focusing in particular on key financial risk controls. They conclude by providing an overview of the Bank of Canada's role in overseeing CDCS.

An Improved Framework for Assessing the Risks Arising from Elevated Household Debt, by Umar Faruqui, Xuezhi Liu and Tom Roberts, describes improvements that have been made to the Bank of Canada's micro-simulation model for assessing the risks emanating from household indebtedness. The expanded version of the model includes asset-side dynamics and other changes that allow for a more flexible modelling of shocks and a better assessment of the evolution of risks over the simulation horizon. The report discusses results, model sensitivity and historical evaluation, as well as areas for future model development.

The Resolution of Systemically Important Financial Institutions

Alexandra Lai and Adi Mordel

Introduction

As events in the recent financial crisis showed, the failure of certain financial institutions (FIs) can have serious negative effects, not only within a domestic economy, but across borders as well, given the global nature of activities undertaken by the largest FIs. Over the past three decades, efforts to secure global financial stability have focused on enhancing the regulation and supervision of internationally active banks to reduce the likelihood that a systemically important financial institution (SIFI) will fail.[1]

Although effective regulation and supervision increase the resilience of the financial system, they do not eliminate the possibility of failure. The chaos that followed the collapse of Lehman Brothers in September 2008 underscored the importance of having a sound resolution regime in place.[2] In addition to avoiding situations where taxpayers are obliged to provide costly bailouts to support financial stability, orderly failure should be an option in order to maintain the efficiency of the system. A dynamic economy is underpinned, not only by a stable financial system, but also by the process that allows non-viable firms to exit so that resources can be reallocated to more efficient uses. Furthermore, firms that believe they will not be allowed to fail tend to take excessive risks, which introduces inefficiencies prior to non-viability. Hence, a policy framework to deal with SIFIs should include arrangements to allow these entities to fail "safely."[3]

Since the crisis, much work has been undertaken at both the international and domestic levels to develop robust resolution regimes. In Pittsburgh (2009) and Toronto (2010), the G-20 leaders asked the Financial Stability Board (FSB) to develop a regime for effective resolution as part of a broad-based policy framework to deal with SIFIs. The new standards established by the FSB (2011a), the "Key Attributes of Effective Resolution Regimes for Financial Institutions" (Key Attributes) were endorsed by the G-20 leaders in November 2011.

Drawing on the failure of Lehman Brothers in order to illustrate the challenges involved, this report describes the need for a special resolution regime for FIs, especially those that are internationally active. It outlines how implementation of the Key Attributes, which build on proposals by the BCBS (2010) and the International Monetary Fund (IMF 2010), would address these challenges. Since most SIFIs operate across a number of jurisdictions, the Key Attributes take into account the necessity of cross-border co-operation for resolving them. The report discusses the key elements required in such models.

1 Systemically important financial institutions are financial institutions whose distress or failure can have significant adverse impacts on the financial system. The category primarily includes banks, but insurance companies and other FIs and financial market infrastructure are being considered for inclusion as well.

2 Resolution involves any action taken by a national authority, with or without private sector involvement, that is intended to address serious problems in an FI that imperil its viability (BCBS 2010).

3 In addition to establishing robust resolution regimes, certain jurisdictions are also enacting reforms to strengthen their financial infrastructure and to make the interconnections among SIFIs more transparent and easier to monitor. Ongoing policy discussions within international forums are focusing on the adoption of appropriate measures, such as changes to a firm's business practices, structure or organization, where necessary, as a complementary measure to improving the resolution regime.

The Need for Special Resolution Regimes

A resolution regime for FIs must take into account the special roles that they play in the economy. These are to intermediate the movement of funds from savers to borrowers and to provide services that facilitate transactions among participants in the financial system.

To perform the first function, FIs engage in "maturity transformation" by taking deposits and issuing short-term liquid instruments to fund longer-term investments. This transformation creates a situation in which the funding liabilities of FIs can be withdrawn on short notice, while the returns from the assets they hold are only realized over the longer term. Maturity transformation makes FIs vulnerable to simultaneous unexpected withdrawals (or runs), especially in periods of financial stress, when market participants can quickly lose confidence in an FI's ability to repay its liabilities.[4] The implication is that, should such a run cause an FI to fail, resolution of the FI must be undertaken swiftly and in a way that preserves confidence in the financial system.

Financial institutions also provide a range of critical services to the financial system, including, for example, supplying facilities for trading securities as well as such infrastructure-like functions as custodial, clearing, settlement and payment-processing services. These services are essential to the smooth functioning of the financial system; however, they also create interlinkages throughout the financial system through which a shock can propagate and amplify. To minimize disruption to the financial system, a resolution regime must allow for the continuation of such critical functions while minimizing the negative effects.

These imperatives for resolution (speed of implementation, preservation of confidence and continuation of critical services) present challenges for ordinary corporate bankruptcy procedures, which can be lengthy and have uncertain outcomes for stakeholders. Furthermore, such procedures tend to rely on asset liquidation (which is inefficient for resolving an FI) and on stays of payments (which will hamper the provision of critical services).[5] The need for special resolution regimes is most evident in the case of SIFIs, which tend to be highly interconnected throughout the financial system and play prominent roles in financial market infrastructures. Indeed, SIFIs present several unique challenges beyond those experienced in the resolution of smaller FIs. These challenges are vividly illustrated by the failure of Lehman Brothers in September 2008.[6]

Lessons from Lehman Brothers

The Lehman Brothers Group, a multinational financial services firm comprising 2,985 legal entities that operated in 50 countries, failed on 15 September 2008. Following the bankruptcy of the holding company, bankruptcy proceedings were initiated against subsidiaries in various jurisdictions. The collapse of this complex institution highlighted the need for a well-defined resolution regime that incorporates several specific elements to enable the orderly resolution of SIFIs: appropriate scope to resolve all SIFIs, pre-crisis planning, ability to provide liquidity support, and coordination across jurisdictions.

First, the impact of Lehman's failure showed that the *scope of a resolution regime* must capture all FIs that could be systemically important. Historically, the U.S. bank resolution regime was designed for commercial banks that raise retail deposits and have access to the financial safety net (deposit insurance and liquidity provided by the central bank). Hence, the only option for winding down SIFIs that were not classified as chartered banks or organized as bank holding companies (and thus not subject to the resolution authority of the Federal Deposit Insurance Corporation) was a corporate bankruptcy proceeding, which is not designed to address the challenges associated with SIFI failures.

Second, the firm's collapse emphasized the importance of *pre-crisis planning* in minimizing spillovers to other financial market participants, preserving franchise value by ensuring that viable entities continue to have access to critical operations and identifying data required to efficiently wind down the firm.[7] For example, thousands of failed trades might have been avoided if there had been contingency plans in place to permit Lehman's prime-brokerage clients to have access to the collateral held for them by Lehman as their custodian. More broadly, an effective resolution plan might have helped authorities to anticipate and avoid the systemic impact of a disorderly windup of the Lehman holding company.

A third issue that became apparent was the necessity for resolution authorities to have *access to temporary liquidity*. U.S. authorities provided liquidity support to Lehman's U.S. broker-dealer arm, facilitating its orderly resolution through an acquisition by Barclays Capital. In the United Kingdom, however, the lack of public sector liquidity support left Lehman's U.K. affiliates illiquid

4 In many countries, deposit insurance exists to prevent runs by retail depositors; however, runs by wholesale depositors or investors unwilling to roll over short-term funding can be just as destabilizing.

5 The liquidation value of an FI's assets tends to be lower than its fair value, since asset purchasers cannot typically realize on the value of lending relationships, or the "soft" information incorporated in bank loans.

6 See Čihák and Nier (2009); BCBS (2010); and Claessens et al. (2010) for more detailed discussions of recent FI failures, including Lehman's.

7 Lehman's U.S. administrators estimate that at least US$75 billion of value was lost because of the lack of preparation for bankruptcy (Claessens et al. 2010).

because cash that was centrally managed at the parent company became unavailable when the parent filed for bankruptcy.[8] As a result, the resolution of the U.S. broker-dealer was much more orderly than that of the U.K. subsidiaries.

Finally, Lehman's failure highlighted the need for *cross-border coordination*. Lehman was structured such that business lines were lodged in different legal entities around the world. Furthermore, the company maintained a fragmented data system across jurisdictions, so that when various entities were spun off (the U.S. broker-dealer to Barclays, investment banking operations in Asia and continental Europe to Nomura, and the asset-management division in a management buyout), insolvency officials from different jurisdictions had no access to data from these operations. The lack of cross-border co-operation made it difficult to salvage value from Lehman's business lines that were still viable when the company failed.

The Financial Stability Board's Key Attributes

Once they have been implemented, the Key Attributes (FSB 2011a) will contribute to more effective resolution of SIFIs primarily by requiring that every FSB member have a resolution regime that can effect the orderly resolution of each FI within its national borders. The adoption of the FSB's Key Attributes by all members is also a necessary step toward achieving the cross-border co-operation needed to successfully resolve SIFIs.

The Key Attributes define the scope of a resolution regime to include any FI whose failure could be systemically significant. Each jurisdiction is required to have a designated administrative authority responsible for leading and exercising resolution powers, with the objectives of pursuing financial stability, ensuring continuity of important financial services, protecting depositors and avoiding unnecessary destruction of value. Some of the authority's key powers should include the ability to override the rights of shareholders, replace management, operate a bridge institution and enforce losses on senior unsecured creditors (bail-in), where warranted.[9] Recognizing the need for preplanning, the FSB requires an appropriate resolution plan for global SIFIs, whose feasibility would be regularly assessed by regulatory authorities.

The Key Attributes also require that the authorities have the powers and facilities to enable them to meet the need for resolution funding without relying on public ownership or bailout funds. However, temporary public funding may still be needed during a crisis—for example, when private funds are not available or are insufficient to restructure large FIs. Thus, resolution regimes should include provisions to recover from shareholders, creditors and the financial industry the costs of providing such funding, as well as any losses incurred during resolution.

Finally, the Key Attributes empower and encourage domestic authorities to achieve a co-operative solution with foreign authorities in resolving a cross-border FI. As a first step, domestic legislation should not contain provisions for automatic actions (which may preclude the possibility of a coordinated resolution strategy) based on insolvency procedures in the foreign jurisdiction. In addition, there should be ongoing information sharing, particularly in relation to resolution and recovery planning.

Cross-Border Resolution

Cross-border co-operation is a critical element of a robust resolution regime. Existing resolution frameworks are established by national law and, without international co-operation, are enforceable only vis-à-vis the legal entities operating within their own jurisdiction. This has been described in the literature as a *territorial* approach to international co-operation. A disadvantage it poses is that the lack of coordination can increase resolution costs. For example, actions taken by one jurisdiction can impose costs on others by damaging the critical functions of other entities in the group through the loss of liquidity or of access to important infrastructure. A more fundamental disadvantage is that territoriality inhibits financial integration and can lead to fragmented, stand-alone banking units that do not benefit from cross-border economies of scale and scope. At the other extreme would be a *universal* approach, whereby resolution proceedings initiated against a financial group as a whole would be undertaken by a global resolution authority. The universal approach would have the potential to minimize resolution losses in a crisis and, in normal times, could provide efficiencies through financial integration.

The requirement by a global resolution authority that national authorities surrender some of their sovereignty is politically challenging. International work has therefore focused on advancing an *intermediate* approach to co-operation (BCBS 2010; IMF 2010). The objective of such an approach is simple. While acknowledging that individual jurisdictions will act in their own self-interest, it aims to create an environment in which the benefits of co-operating outweigh the benefits of acting unilaterally. Such an environment increases the likelihood that

8 The situation was further complicated in the United Kingdom by the lack of debtor-in-possession (DIP) financing, a special form of financing available in the United States for companies in distress. DIP lenders often receive a "super priority" lien that puts them ahead of even the first lien holders. This offers an incentive for stakeholders to continue to provide credit to a firm during resolution.

9 A bridge institution is one that is temporarily established and operated to acquire some or all of the assets and liabilities of a failed institution until final resolution can be completed.

jurisdictions will co-operate in resolution efforts. In the next section, we describe the key elements required to achieve this: (i) making co-operation feasible; and (ii) enabling the benefits from co-operation to be identified under severe time constraints. These key factors will reduce the divergence of interests among different countries in a crisis and should promote coordinated resolution efforts.

Making co-operation feasible

The first step in promoting co-operation is to establish a forum for the ongoing exchange of information and the coordination of recovery and resolution measures related to each SIFI. The FSB's Key Attributes require that crisis-management groups (CMGs) be established for SIFIs identified by the FSB and the Basel Committee on Banking Supervision as being of *global* importance (G-SIFIs) (FSB 2011b).[10]

To make co-operation possible, any legal impediments must be removed so that each participating jurisdiction has the ability to share information, recognize resolution proceedings and measures undertaken by a SIFI's home authorities, and treat all creditors equally, regardless of their location. At a minimum, as required by the Key Attributes, national resolution regimes should not contain automatic triggers leading to actions that could hamper co-operative measures aimed at stabilizing or resolving a cross-border FI. The European Commission's proposed coordination framework goes further by providing for a temporary stay (of short duration) following the entry into resolution proceedings by two or more of a SIFI's legal entities, during which time the authorities in the host country are not permitted to take unilateral actions that could prejudice the effectiveness of a group-level resolution strategy (EC 2010, 2011).

It is also essential to promote convergence in national regulatory, supervisory and resolution regimes. This is the main focus of the Basel Committee's Capital Accord (2005) and "Core Principles for Effective Banking Supervision" (2011), as well as of the FSB's Key Attributes. It would also be helpful if public sector support facilities available to FIs (lender-of-last-resort and deposit insurance facilities) were compatible across participating jurisdictions.

As a practical matter, procedures for coordination need to be in place for each SIFI. The Key Attributes call for countries with G-SIFIs to establish institution-specific co-operation agreements detailing the procedures for coordination among home and host-country authorities.

Making it easy to identify the benefits of co-operation during a crisis

Co-operation is more likely to occur if the parties are aware of the benefits it offers. This can be partly achieved by adequately preparing for crises via internationally coordinated resolution planning. The Key Attributes require a resolution plan to detail how critical services provided by a firm and its subsidiaries would be maintained during resolution and how the necessary strategies would be financed. As well, the plan would identify any impediments that might arise with respect to these resolution strategies. The plan should also clarify the extent and form of domestic and international co-operation that would be required to implement an efficient group-wide resolution. Authorities should explore when, and how likely, national authorities are to "ring-fence" (so that home authorities no longer have access to the assets located in the jurisdiction of the ring-fenced entity), and what the consequences of that might be for other jurisdictions. To be useful, the resolution plan should be subject to realistic scenario simulations, and reviewed and updated by authorities regularly. The Key Attributes require resolution plans and resolvability assessments to be undertaken and reviewed annually by CMGs for each of the identified global SIFIs.

Information sharing should be mandatory, especially during crises and resolution proceedings, even if such measures are undertaken separately by each national authority for a legal entity in its jurisdiction. To date, the effective exchange of cross-border information has been hampered by two obstacles: (i) confidentiality restrictions limit the ability of authorities to share information, and (ii) the lack of a clear and harmonized understanding across countries of the kind of information that should be shared, its level of detail, who should receive it, and when. Although confidentiality issues are difficult to address, maintaining consistency and clarity around these issues by, for example, establishing minimum standards of information sharing, would be useful.

Setting out principles for burden sharing in advance of a crisis will support the adoption of co-operative resolution actions.[11] In general, authorities are reluctant to commit to such principles during a crisis, but it would be beneficial if they could agree to them in advance, during more tranquil times. While these principles do not necessarily constitute legally binding agreements, they would help national authorities to compare the potential costs of undertaking a coordinated approach to resolution versus taking unilateral actions. These principles

10 A G-SIFI is a systemically important financial institution whose failure is likely to have the most significant impact on the global financial system. The initial list of G-SIFIs published by the FSB on 4 November 2011 will be updated annually. At present, no Canadian bank has been identified as a G-SIFI.

11 Goodhart and Schoenmaker (2009) outline several of the forms that burden-sharing agreements can take.

are not required by the Key Attributes, but the academic literature on cross-border co-operation has identified their value in co-operation models.

In sum, by providing a framework to make co-operation feasible, as well as making it easier for jurisdictions to see the benefit of co-operating in times of crisis, implementation of the Key Attributes will be critical to improving resolution outcomes. Achieving co-operation during a crisis can be challenging, however, especially if the benefits are not evenly distributed across jurisdictions. Even with a well-established framework, attempts at co-operation can fail.[12]

A practical first step to increase the likelihood of successful co-operation is the series of peer reviews that the FSB will undertake of its member jurisdictions' implementation of the Key Attributes. These peer reviews and assessments should provide regulators with more information about whether removing the technical obstacles and creating an environment that enables authorities to see the benefits of co-operating are sufficient to encourage cross-border co-operation in a crisis. In particular, it is hoped that they can help regulators to understand how to manage any divergence in interests that might remain.

12 The experience with the resolution of the Fortis Group is a case in point. The Fortis Group was a financial conglomerate with subsidiaries in Belgium, the Netherlands and Luxembourg that was partially nationalized on 28 September 2008. Although there was an initial coordinated resolution strategy on the table, Fortis was only resolved along national lines in mid-2009, in a protracted process that destroyed franchise value. The reason for this was a divergence of interests, since the Belgian authorities wanted to keep Fortis whole, but the Dutch authorities wanted to return ABN-AMRO (which Fortis had acquired prior to its failure) to Dutch control by divesting it from Fortis. A European Union Memorandum of Understanding (ECB 2008) on cross-border co-operation, signed in June 2008, failed to provide for sufficient co-operation when interests among the national authorities diverged.

Conclusion

Effective resolution is a core component of a policy framework for addressing the problem of financial institutions that are too big to fail. Internationally consistent implementation of the FSB's Key Attributes will contribute to a more effective resolution of SIFIs, primarily by ensuring that members of the FSB have effective resolution regimes in place to implement the orderly resolution of all FIs within their borders. Consistent implementation is also a necessary and important step toward achieving the cross-border co-operation required to effectively resolve SIFIs, by reducing divergence in national interests during a crisis.

The internationally consistent implementation of the Key Attributes is therefore a key priority of the FSB (2011c). To this end, in the second half of 2012, the FSB will initiate the first in a series of peer reviews of its member jurisdictions to assess their implementation of the Key Attributes. Beginning in 2013, the current group of 29 G-SIFIs will also be assessed against the FSB's requirements for CMGs, resolution plans and resolvability assessments. These peer reviews and assessments will be critical inputs into the ongoing work to improve the incentives for cross-border co-operation during a crisis.

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Reducing Systemic Risk: Canada's New Central Counterparty for the Fixed-Income Market

Pothik Chatterjee, Lana Embree and Peter Youngman

Introduction

On 21 February 2012, the Canadian Derivatives Clearing Corporation (CDCC) launched the first phase of its new central counterparty (CCP) service for the fixed-income market. The new fixed-income CCP centrally clears repurchase agreements (repos) of securities issued by the Government of Canada and federal Crown corporations. It is part of the Canadian Derivatives Clearing Service (CDCS), which also clears exchange-traded derivatives and certain over-the-counter derivatives. CDCC and financial market participants are now focusing on further developing the fixed-income CCP by expanding the markets it serves.

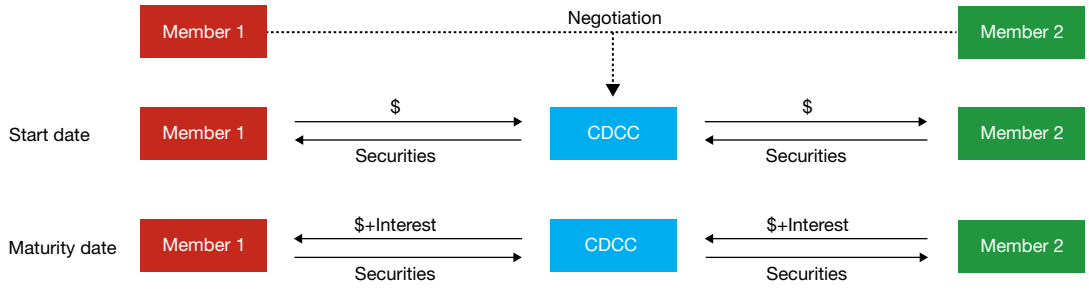
The repo market for Canadian fixed-income securities is a core funding market (Fontaine, Selody and Wilkins 2009). Repos—transactions involving the sale of a security with the simultaneous agreement to repurchase it at a later date, for the original price plus interest—are the economic equivalent of secured loans. A resale agreement, or "reverse repo," is a repo considered from the perspective of the other party.[1] The market for such transactions provides essential liquidity to domestic financial institutions and market-makers, which in turn provide liquidity to the broader financial system. At the height of the financial crisis in September and October of 2008, this market experienced periods of illiquidity as financial institutions became increasingly concerned about counterparty credit risk and balance sheets became constrained (Chande, Labelle and Tuer 2010).

A CCP is an entity that intermediates financial transactions by becoming the buyer to every seller and the seller to every buyer for the transactions that it clears through a legal process known as "novation" (**Figure 1**).[2] The introduction of an appropriately risk-controlled CCP for the fixed-income market improves this market's resilience by mitigating counterparty credit risk, thus reducing the potential for disruptions to be transmitted through the financial system. This supports the ability of the market to remain continuously open, even in times of stress. A CCP also provides balance-sheet relief to its members through netting efficiencies.

1 See also Morrow (1995).

2 Novation is the act of either replacing an obligation to perform with a new obligation, or replacing a party to an agreement with a new party. For an explanation of other terms and processes related to CCPs, see Chande, Labelle and Tuer (2010).

Figure 1: Novation of a repo trade



Given the centrality of the underlying market, the Bank considers that CDCS could pose systemic risk if appropriate risk controls are not in place (i.e., it is systemically important). The Governor of the Bank of Canada has therefore designated it for oversight under the Payment Clearing and Settlement Act (PCSA).

The Canadian Fixed-Income Market

The fixed-income market has several important functions within the Canadian financial system. Governments and corporations obtain funding by issuing fixed-income securities in the primary market. In addition to their importance in the primary market, prices established in the secondary market for Government of Canada securities also serve as an important benchmark for the pricing of securities issued by provincial governments and corporations. A liquid secondary market allows holders to obtain cash in exchange for the securities before the securities mature, and provides other investors with a greater selection of securities for purchase than just those currently being issued by governments and corporations. At the end of 2011, approximately $2 trillion was outstanding in Canadian-dollar-denominated fixed-income securities. Bonds and treasury bills issued by the Government of Canada accounted for a large portion of that total, about $601 billion (Bank of Canada 2012).

There is an active repo market for Government of Canada securities, which is also an important part of the financial system. A variety of institutions participate in this repo market: investment dealers and banks use it both as a source of low-cost secured funding as well as a means of financing long positions of securities and covering short positions resulting from sales. These activities allow market-makers to generate liquidity for the broader financial system and to maintain liquid secondary markets (Fontaine, Selody and Wilkins 2009). Other types of institutions, such as insurance companies and pension funds, are also active in the repo market, using it primarily as a tool to handle temporary shortfalls or surpluses of cash, but also to manage their balance sheets. The repo market is dominated by Government of Canada securities, which, as of December 2011, are the underlying collateral for about 69 per cent of transactions (Bank of Canada 2012). Also as of December 2011, an estimated $79 billion of Canadian-dollar repos outstanding was held by federally regulated financial institutions (OSFI 2012).

Why a Fixed-Income CCP Is Necessary in Canada

During the financial crisis, the Canadian fixed-income repo market, like those in other countries, experienced periods of illiquidity as a result of lenders of cash taking measures to reduce their credit exposures to borrowers. When many lenders undertook these measures simultaneously, the amount of financing available was abruptly reduced, creating severe funding pressures in the repo market.

The crisis also generated heightened uncertainty regarding the credit quality of many financial firms involved in the funding markets. Lenders of cash therefore became less willing to assume credit exposures. To limit their risks, banks and investment dealers engaged in fewer transactions, limited the terms of transactions and demanded higher-quality collateral from borrowers.

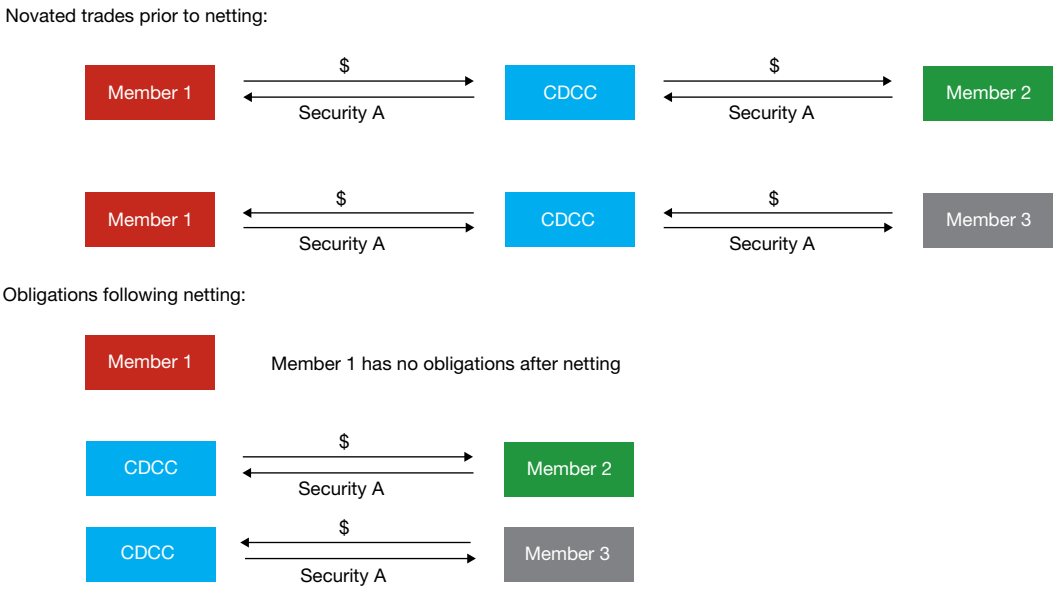
As anxieties about counterparty credit risk spread throughout the system, banks faced pressures to limit the expansion of their balance sheets. These pressures came from a variety of sources, including: (i) counterparties that demanded collateral to support existing obligations; (ii) clients who sold them their riskier assets; and (iii) clients who drew upon off-balance-sheet lines of credit as a source of precautionary liquidity. Seeking ways to offset these pressures, and in the absence of a CCP for the Canadian repo market to facilitate balance-sheet netting, banks sharply curtailed their repo activity. This reaction exacerbated the liquidity funding pressure and increased market turbulence. The decrease in repo activity was relatively more pronounced in Canada than in other jurisdictions, since repo business accounted for a greater share of the balance sheets of domestic banks than it did for their global competitors.

By helping to mitigate counterparty credit risk and alleviate the resulting pressures on bank balance sheets, a CCP for the fixed-income repo market supports continuously open markets.[3] Indeed, jurisdictions that had CCPs for their repo markets in place before the crisis were relatively less affected than those that did not. A CCP reduces risk aversion among counterparties by becoming a trusted intermediary between them. CCPs further reduce counterparty credit risk by increasing netting potential. Moreover, a CCP with robust risk controls and clear default-management processes helps individual CCP members to better understand their exposures should another clearing member default.

To minimize the potential contraction of the repo market resulting from balance-sheet pressures during future stressful periods, members of the Investment Industry

3 See Carney (2008) for a discussion of the concept of continuously open markets.

Figure 2: A simple example of settlement netting



Association of Canada (the industry) sought ways to increase netting efficiencies in order to offset repo and reverse repo transactions on the asset and liability sides of the balance sheet.[4] The industry concluded that an appropriately designed CCP would allow them to reduce their balance-sheet exposures to the repo business by netting offsetting positions without changing their underlying repo activity. Using a CCP would therefore create a more resilient and efficient balance sheet that could absorb financial shocks with greater ease.

The Role of CDCS in the Canadian Financial System

CDCC was selected by the industry to develop central clearing services for Canadian fixed-income markets. CDCS clears all derivatives contracts traded on the Montréal Exchange, as well as some over-the-counter equity options. Since the introduction of the new CCP service in February 2012, CDCS also clears repo transactions in fixed-income securities, a service in which the major dealers in the fixed-income market participate.

In performing these functions, CDCS has linkages to other Canadian financial market infrastructures. Fixed-income trade information is first submitted through CDSX, Canada's central securities depository and securities settlement service, which then sends qualified trades to CDCS for novation. Since virtually all trades in Canadian-dollar-denominated fixed-income securities are settled in CDSX, the novated trades are submitted to CDSX for settlement.[5]

Throughout most of the trading day, CDCS submits trades to CDSX for gross (i.e., individual) settlement as the trades are novated. There are, however, two intraday netting sessions where CDCS will attempt to net together any trades that have not yet settled. As well, there is an overnight session where trades that were submitted to CDCS before the settlement date are netted.[6] As shown in **Figure 2**, the intraday or overnight netting sessions can offset a clearing member's obligations to deliver and receive a particular security. This reduces the clearing member's obligation to deliver funds or securities and therefore increases the efficiency of the settlement process. The net obligations are then submitted to CDSX, where they are settled like any other trade. To facilitate smooth settlement, clearing members are required to meet minimum purchase obligations shortly after the intraday netting sessions.

Risk Management

CDCC has established arrangements to manage the various risks that a CCP faces, including legal, operational and financial risks. In this report, we focus on two key financial risks, credit risk and liquidity risk,

4 Without a CCP, if a bank transacts in both a repo and a reverse repo for the same security and term, but with different counterparties, both a liability and an asset are created on the bank's balance sheet. If both trades are novated by a CCP, however, the bank would have offsetting trades with the same counterparty, allowing the counterparties to net the trades and not create separate assets and liabilities on their balance sheets.

5 Settlement of a fixed-income trade means the exchange of cash for securities. Both the sale and the repurchase leg of a repo transaction generate fixed-income settlements.

6 This would also include the repurchase leg of repo trades, since this information was submitted to CDCS when the repo trade was negotiated.

because controlling these risks is key to containing overall counterparty risk in the system. In this context, credit risk is defined as the risk of a permanent financial loss that results from the default of a clearing member, while liquidity risk is defined as a temporary shortfall of cash, either during the course of a day or over a period of one or more days.

Credit risk

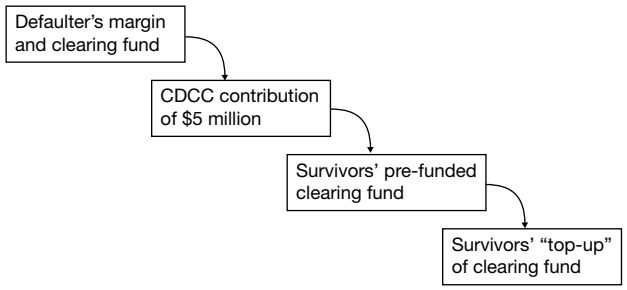
Through the novation process, all CCPs assume credit risk; that is, even if one of the CCP's clearing members fails to meet its obligations, the CCP must continue to meet its obligations to the remaining members, creating the potential for financial loss for the CCP. For example, in the fixed-income service, CDCC could face a loss if the repo party (the borrower of cash) defaulted before the repo matured and the price of the underlying collateral fell. In such a case, CDCC would have to purchase the security from the non-defaulting party on the maturity date of the repo and sell it in the market ("close out") at the lower prevailing price. Following standard practice for CCPs, CDCC collects financial resources from its members to mitigate this risk.

The financial resources collected by CDCC to mitigate credit risk are a blend of "defaulter pays" and "survivors pay."[7] A variation margin and an initial margin are defaulter-pays resources. On an intraday basis, every clearing member is required to pay to CDCC a variation margin on each trade or portfolio of trades to offset any loss in value of their portfolio since the variation margin was last updated. Members whose portfolios have gained value receive a variation margin payment from CDCC. Thus, a variation margin collateralizes the credit exposures the CCP faces vis-à-vis its members, based on current market prices.

CDCC also collects an initial margin to collateralize credit exposures it could face if market prices move significantly. Initial margins are computed on the basis of the historical volatility of the trades in each clearing member's portfolio and are paid by all clearing members. Taken together, the variation margin and initial margin are meant to ensure that, under normal market conditions, CDCC would not suffer a financial loss from the default of any clearing member.

CDCC's financial resources are further augmented by the survivors-pay clearing fund, which mutualizes losses that CDCC could incur if it was required to close out a defaulter's positions under extraordinary market conditions.[8] CDCC determines the size of the clearing fund by conducting stress tests that estimate the credit loss that would result from the default of the largest clearing member under extreme, but plausible, market conditions. Members contribute to the clearing fund in proportion to the risk that they represent to the CCP.

Figure 3: Default-management waterfall



As depicted in **Figure 3**, in the event that CDCC faced a credit loss in closing out a member's positions, the defaulter's variation and initial margin and clearing-fund contributions would be used first to absorb these losses. If this were insufficient, CDCC would use its capital to absorb the next $5 million of losses. If these funds were still not enough, residual losses would be borne by the surviving members' contributions to the clearing fund. Members would be obliged to make an additional "top-up" contribution to the clearing fund of up to 100 per cent of the value of their original contribution. This cascade of collections is known as a CCP's "default-management waterfall."

Clearing members can meet their margin and clearing-fund obligations with cash or securities, subject to certain restrictions. Members pledge eligible securities to CDCC's account at CDSX, while cash is deposited to CDCC's settlement account at the Bank of Canada through payments made via the Large Value Transfer System (LVTS). Having a settlement account at the Bank of Canada rather than at a private financial institution mitigates banker risk, which is the risk of failure by a private institution acting as settlement agent for a financial market infrastructure.

Liquidity risk

Like all CCPs, particularly those in repo markets, CDCC faces considerable liquidity risk. In the fixed-income service, CDCC manages sizable intraday requirements and, in the event of a member default, must also manage potential interday liquidity demands.

7 CPSS (2003) defines a defaulter-pays loss-sharing arrangement as "a loss-sharing arrangement where each participant is required to collateralise any exposures it creates for other participants." It defines survivors-pay arrangements as "loss-sharing arrangements which, in the event of a participant's inability to settle, require losses to be borne by the surviving participants according to some predetermined formula."

8 Many CCPs refer to this as a "default fund."

As part of the novation process, CDCC has obligations to purchase securities, which it must settle in CDSX using intraday lines of credit. If CDCC has fully drawn its intraday credit to settle purchases of securities, it must settle sales of securities to repay the line of credit and allow the settlement process to continue. Thus, if clearing members are not settling their purchases from CDCC promptly, this could prevent CDCC from meeting its obligations in an orderly fashion over the course of the day. The netting sessions described above, in combination with the members' minimum purchase obligations and CDCC's provisions for an adequate amount of intraday credit, mitigate this risk and promote an orderly settlement of obligations over the course of the business day.

CDCC could also face intraday and interday liquidity risk in the event of a member default, since it would still be required to settle all transactions on their original value date. For example, if a clearing member defaulted before settling its purchases, CDCC would be obliged to continue to buy the securities from the surviving members, knowing that the defaulter would not in turn buy them from CDCC. Therefore, it would be necessary for CDCC to finance its purchase of the securities until they could be liquidated in the market. To manage this risk and facilitate an orderly liquidation process, CDCC has entered into an agreement with a syndicate of banks for an emergency repurchase facility that allows CDCC to obtain funds by conducting repo transactions with the syndicate, allocated equally to each bank in the syndicate. The facility was designed to be large enough to manage the default of the clearing member (and its affiliates) that has the largest obligation to purchase securities from CDCC, even if the defaulter is one of the banks in the syndicate. Should all of CDCC's private sources of liquidity be insufficient to manage a default, the Bank of Canada has the discretion to act as liquidity provider of last resort on a secured basis.

The legal rules that govern CDCC's management of a default, together with the financial resources available to address credit risk and liquidity risk, enhance the stability of the repo market by ensuring an orderly winding down in the event of the default of a major dealer or bank, as well as ensuring that all novated transactions continue to settle as expected.

Bank of Canada Oversight

Under the Payment Clearing and Settlement Act (PCSA), the Governor of the Bank of Canada may designate an eligible system subject to Bank oversight if the Governor is of the opinion that the system could be operated in such a manner as to pose systemic risk.[9] The Bank has issued a guideline (Bank of Canada 2002) that describes the characteristics of a system that would warrant close attention as the decision of whether or not to designate is being considered. These characteristics are (i) the size of the transactions and of the market being served; (ii) the risk exposures; and (iii) the centrality of the system.

CDCS exhibits all three of these characteristics. The most important is the centrality of CDCS, which reflects its importance to the funding market and its linkages with other designated systems, namely, CDSX and the LVTS. As well, since CDCS is a central counterparty, risks that had been decentralized in bilateral transactions are concentrated into a single entity, CDCC. Finally, the market that CDCS serves is quite large, as discussed above, and a significant portion of the market is expected to be cleared through CDCS, particularly as the industry and CDCC complete their efforts to expand the fixed-income CCP services. Because of the market's size, as well as CDCS's centrality and risk exposures, it is crucial that the system incorporate appropriate risk controls.

The Governor of the Bank of Canada has designated CDCS as systemically important, effective 30 April 2012. Designation provides legal protections for the system's rules, helping to ensure finality of settlement in cases of default, and provides the legal basis for oversight of the system. The Bank undertakes oversight—which is broadly described in the PCSA and is facilitated by a regulatory oversight agreement with the system operator—to ensure that the system is operated in such a manner as to control systemic risk. The Bank's oversight responsibility applies to CDCC's derivatives business as well as to the new fixed-income business, since all of these services are operated under the same legal entity (CDCC) using a common clearing system (CDCS). The oversight process includes reviewing significant changes to the system or its rules, reviewing the results of audits and defining standards.

The Bank's standards for oversight are guided by international standards that provide guidance on the risk management of a CCP, including legal risk, operational risk, financial risk, default management and governance (CPSS-IOSCO 2004). The Bank will be adopting the new CPSS-IOSCO Principles for Financial Market Infrastructures (CPSS-IOSCO 2012) as part of its risk-management standards.

9 The PCSA defines systemic risk in terms of the impact that a problem experienced either by the system or by a participant could have on other participants, systems or financial institutions. The Minister of Finance must be of the opinion that designation for Bank of Canada oversight is in the public interest. In addition to CDCS, the Bank has designated and oversees three other systems: the LVTS, CDSX and CLS.

Table 1: Development of the Fixed-Income CCP

	Type of service introduced	Eligible securities	Status
Phase 1	Single-security bilateral repos	Government of Canada bonds and treasury bills or fixed-income securities issued by federal Crown corporations	Launched
Phase 2	Cash trades; interdealer brokered cash and single-security repos		Planning
Phase 3	General-collateral repo		Planning

In fulfilling its oversight responsibilities, the Bank works closely with the relevant financial market regulators, the Autorité des marchés Financiers and the Ontario Securities Commission.[10]

Next Steps

With the successful launch of the first phase of the fixed-income service, CDCS clears bilaterally negotiated repurchase transactions on eligible securities.[11] Given the benefits of CCPs, CDCC and the industry are working to expand the CCP service to additional segments of the fixed-income market and are planning to introduce two additional phases (**Table 1**).

The second phase will expand the CCP to clear cash fixed-income trades as well as trades transacted using interdealer brokers, which act as intermediaries between dealers to facilitate trades. While interdealer brokers already offer anonymous cash trades, all repo trades are completed on a "name give-up" basis, where the names of both parties to the trade are revealed. Completion of the second phase will allow interdealer brokers to offer anonymous trading for repos cleared by the CCP, which are known as "blind" repos.

The third and final phase will introduce central clearing for the Canadian general-collateral repo market. Currently, general-collateral repo is traded as specific repos on a bilateral basis, but is not centrally cleared. In this type of transaction, the lender of cash is willing to accept as collateral any securities from a pre-specified list of eligible securities, provided their total value equals or exceeds the amount of cash loaned. The introduction of the general-collateral service is expected to significantly enhance the efficiency of the funding market and to contribute to the development of a more-liquid market for term repos. Investing institutions such as asset managers, pension funds and insurance firms, which make up most of the "buy-side," represent a large portion of repo market activity. The presence of a well-functioning repo market, including a robust term repo market, during times of crisis will offer a strong incentive for the buy-side to become direct or indirect participants of the CCP in its third phase.

Conclusion

A new CCP for bilateral repo transactions with robust risk-management processes is now operational in Canada. The first phase of the CCP project has delivered some benefits to the financial system. The next phases will add to these benefits by offering increased netting efficiencies and attracting the participation of a broader group of investors to a transparent and resilient term market, thus improving the liquidity of the fixed-income market. The benefits from this infrastructure will increase as the two remaining phases of development are fully implemented and a broad and diverse group of participants join the service.

10 CDCC is regulated in Quebec by the Autorité des marchés Financiers (AMF). CDCC is currently exempted from registration as a clearing agency in Ontario by order of the Ontario Securities Commission (OSC). Both the OSC and the AMF regulate the operator of CDSX, to which CDCS has close links.

11 CDCC launched the service on 21 February 2012 and, over the next three months, gradually increased the number of securities eligible for clearing. This approach was used to allow the values and volumes cleared through the new fixed-income CCP to increase as the industry and CDCC gained experience with the service.

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An Improved Framework for Assessing the Risks Arising from Elevated Household Debt

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Introduction

Since 2008, the Bank of Canada has used a micro-simulation model as one of its tools to assess the risks to financial stability emanating from the elevated debt burdens of Canadian households. The strength of this approach is its use of actual household balance sheets to examine the distribution of debt within the household sector.[1] Unlike aggregate measures such as the ratio of household debt to income, this distributional information provides insight into the most vulnerable segments within the household sector—where problems would first arise.

This report describes the improvements that have been made to address limitations in the previous version of the model and incorporates a set of scenarios to illustrate these improvements. Most notably, the model can now simulate a multi-year unemployment shock, with expanded dynamics that include the asset side of household balance sheets, in addition to the debt and income dynamics that already made up the core of the model (**Box 1**).[2]

These features provide increased flexibility to adjust the characteristics of a shock scenario. The enhancements allow for greater insight into the interactions between different sources of risk, as well as a better assessment of the evolution of risk over the simulation horizon, as indicated by the share of households with an elevated debt-service ratio (the ratio of debt payments to income) and the effect of a shock on loan arrears.

The new version of the model—the Household Risk Assessment Model (HRAM)—will be used to conduct the household stress tests reported in this and future issues of the *Financial System Review* (FSR). Although a single model cannot provide a comprehensive account of all possible risk interactions, HRAM is an important part of the Bank's ongoing development of complementary approaches for monitoring risks in the household sector.

More Flexible Modelling of Unemployment Shocks

A negative shock to the labour market is an important potential source of financial stress in the household sector. Previous analyses published in the FSR examined this risk by first simulating the distribution of the debt-service ratio (DSR) under a stable set of macro assumptions for 10 quarters, and then imposing an unemployment shock on this distribution. The model then calculated loan arrears over a 1-year period following the unemployment shock. HRAM, however, offers greater flexibility to assess the impact of a wide range of scenarios on household vulnerabilities and loan arrears by adjusting the timing, severity and persistence of the shock. For example, it can evaluate the impact on loan arrears of a sharp but short-lived unemployment shock or a slow and persistent increase in unemployment over a multi-year horizon. By allowing all of the scenario assumptions to evolve simultaneously with the unemployment shock, HRAM also increases the coherence of the scenario throughout the stress test.[3]

The number of unemployed households in each period is determined by the assumptions for the unemployment rate and its average duration (in weeks). Unemployed households in a given period are defined as the sum

1 Data are from the Canadian Financial Monitor survey compiled by Ipsos Reid. The data include information on balance sheets, income, debt payments and other characteristics related to household finances for about 12,000 households that are representative of the Canadian population.

2 The version of the model used in previous analyses reported in the *Financial System Review* is outlined in Djoudad (2010; 2012).

3 For example, the shock scenario described later in this article incorporates adjustments to credit growth, income growth and risk premiums in response to a macroeconomic downturn. In the previous version of the model, there was no adjustment of these other variables after the unemployment shock was introduced at the end of the simulation period.

Box 1

Core Features of the Simulation Model

There are three steps in the stress-testing exercise. First, a scenario representing a stressed macro environment is defined. This scenario includes assumptions for the level of interest rates and the aggregate growth rates of household credit and income. Second, using the latest microdata as the starting point, each household's debt-service ratio (DSR) is simulated over the projection horizon by allocating credit and income growth across individual households.[1] While these individual growth rates vary, the combined outcomes are consistent with the assumptions in the aggregate scenario. Finally, based on the simulated distribution of the DSR across all households, we estimate the effects of an adverse shock on loans in arrears.

The core debt and income dynamics in HRAM are unchanged from the previous version of the model. The distribution of credit growth depends on household-specific characteristics such as income, housing wealth, a household's initial DSR and whether it is a first-time homebuyer. Consistent with empirical evidence, households with higher current income and wealth and a lower DSR tend to have better access to credit and can accumulate more debt than other households. Unemployed households cannot obtain additional credit.

Income growth is simulated by grouping employed households into five income categories. For each category, household-specific income growth is randomly drawn from a normal distribution. Mean income growth and the standard deviation can vary across income groups, in line with the empirical evidence (Djoudad 2012).

The borrowing cost of variable-rate debt responds immediately to changes in the overnight rate or the risk premium for household debt. For fixed-rate mortgages, we assume that the proportion of households whose mortgages are renewed in a given year is equal to the reciprocal of the term to maturity. For example, for a 5-year term, 20 per cent (1/5 = 0.2) of households would renew their mortgages each year at current rates. Thus, the average borrowing rate for all outstanding debt—the "effective household borrowing rate"—will change more gradually than the interest rate for new loans.

1 In the new version of the model, households can also accumulate financial assets.

of households that were unemployed in the previous period and remain unemployed, plus newly unemployed households.[4] Once a household is unemployed, it loses its labour income but may receive employment insurance. To account for living expenses, only a fixed proportion of employment insurance, and of any income from a second income earner, are available to unemployed households for debt-servicing costs. If these sources of funds are insufficient to cover the household's needs, it can draw on its liquid financial assets[5] until all of these assets are depleted.[6] When a household becomes re-employed, it is reassigned its initial employment income.[7]

For each period, HRAM keeps track of every household's labour force status, ability to make debt payments and financial wealth. Once a household is three months or more behind in its debt payments, it is categorized as being in arrears.[8] A distinguishing feature of the unemployment shock in HRAM is that, unlike the previous version of the model, households can cycle in and out of periods of unemployment over the simulation.

Improved Dynamics for Household Financial Assets

The financial assets held by households play a significant role in the model because unemployed households can use these assets to service their debt and avoid (or delay) going into arrears. As a result, a downturn in financial markets or changes in savings behaviour could affect arrears. To capture these effects, the new model allows the asset side of household balance sheets to evolve over the simulation period.

Changes in the total value of financial assets occur through three channels in HRAM: (i) household savings from current income; (ii) asset-price movements; and (iii)

4 Unemployment is assigned randomly across households in the workforce. In reality, some households (based on region, age and employment sector) would have a higher probability of unemployment than others, which might become important if vulnerable households are disproportionately affected by a downturn. The duration of unemployment for each unemployed household is also assigned at random and is limited to a range of one to 99 weeks. The assumed distribution of duration reflects empirical evidence that, while periods of unemployment are generally short, there is a significant share of long-term periods. For example, among the unemployed households questioned by Statistics Canada in 2011 for the Labour Force Survey, about 62 per cent had been unemployed for 13 weeks or less, while 22 per cent had been unemployed for more than 26 weeks.

5 These include cash, bonds, stocks and mutual funds.

6 In the model, households cannot borrow to cover a shortfall in debt-servicing obligations.

7 In reality, human capital tends to depreciate over longer periods of unemployment, which would affect a household's income when it becomes re-employed. Tests suggest that this modification would likely not have a significant impact on the simulation results.

8 Financial institutions typically start to provision for losses when loans are three months in arrears.

household dis-savings (for example, when liquid assets are drawn down during periods of unemployment). The first two channels were not present in the previous version of the model, and the third was confined to the end of the simulation exercise when the unemployment rate was assumed to rise.

The aggregate savings rate of the household sector follows an assumed path for the scenario, but the savings rate varies across households. Specifically, households are allocated savings based on an econometric estimation of the relationship between savings and household-specific characteristics such as income, debt payments, the current level of assets (divided by the number of working years) and age. The savings allocation for any particular household cannot exceed a budget constraint (which takes into account debt payments). This approach helps to ensure that savings are allocated according to financial capacity and savings preferences, and reflects empirical evidence that savings behaviour is uneven across households.

Changes in the prices of financial assets have a direct effect on the wealth of households. The returns on key categories of assets (e.g., stocks and bonds) are chosen to be consistent with the scenario. Household asset holdings are adjusted at the end of each simulation period to reflect both savings and the returns on financial assets. During a recession, when unemployment rises and returns on financial portfolios are negative, a household's wealth—and potentially its ability to weather a period of unemployment—declines. Simulation results presented later in this report suggest, however, that the asset-price channel has a smaller *direct* impact on loan arrears than the savings channel.

As noted earlier, liquid financial wealth in the form of cash and marketable securities is used by unemployed households to make debt payments if employment insurance and other income (for two-income households) are insufficient. Thus, for some unemployed households, financial wealth declines from one period to the next because of withdrawals for debt payments.

Putting HRAM to Work: Outputs, Assumptions and Analysis of the Key Changes to the Model

In this section, we outline the impact of the changes described above on the results produced by the model. The analysis is presented in two steps. First, we review the main outputs of the model and describe the scenario assumptions for our illustrative exercise. Second, we assess the results.

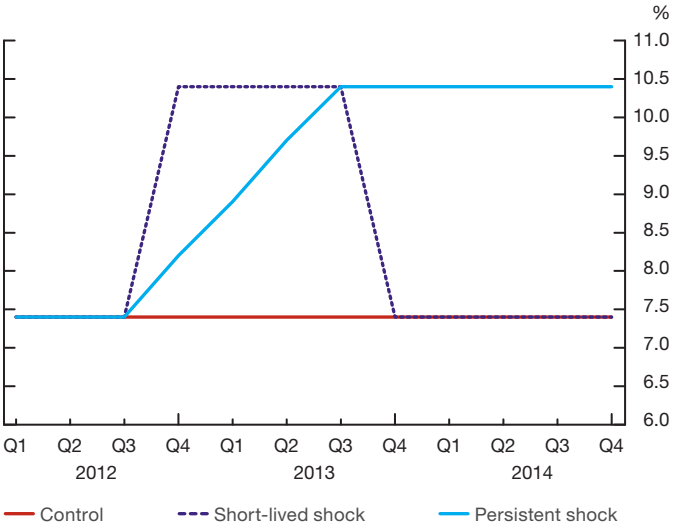
Model outputs and scenario assumptions

Like the previous version of the model, HRAM has three main simulation outputs: (i) the share of vulnerable households among indebted households, where a vulnerable household is defined as having a DSR that is equal to or greater than 40 per cent;[9] (ii) the share of total household-sector debt held by *vulnerable* households; and (iii) the share of total household debt that is three or more months in arrears.[10, 11]

The first two measures show how the most vulnerable part of the distribution of household DSRs changes over the simulation period. The loan arrears rate describes the share of outstanding household debt that is currently distressed.

To illustrate HRAM's flexibility, we consider the model's response under four scenarios: a control scenario, a short-lived unemployment shock, and a persistent unemployment shock *with* and *without* asset dynamics from savings and returns on financial assets.[12] A subset of these assumptions is highlighted in **Chart 1**, **Table 1** and **Chart 2**.

Chart 1: Unemployment rate: Assumptions



9 Following industry standards, a household is expected to have more difficulty making loan payments when its DSR is equal to or greater than 40 per cent.

10 These measures are described in more detail in Djoudad (2010).

11 The model generates a flow of new arrears in each simulation quarter, while available data on arrears are measured as a stock (as a percentage of debt). To translate the flow into a stock, the model assumes that new mortgage arrears are written off by banks (or return to regular payments) after 2.5 quarters, on average, whereas, consistent with financial reporting rules, the duration is one quarter for consumer loan arrears (which exclude mortgages).

12 None of these scenarios represents the Bank's view on the most probable outcome for the macroeconomic environment or household sector risk. Instead, they illustrate vulnerabilities in the household sector under a range of hypothetical situations.

Table 1: Main assumptions for control and shock scenarios

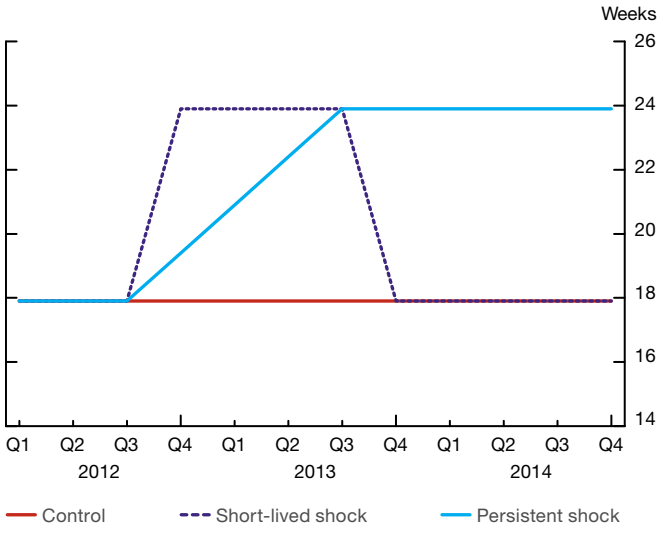
	Credit and income (quarter-over-quarter annualized growth, per cent)				Interest rates (basis points)				Unemployment (per cent)	
	Control		Persistent shock		Control		Persistent shock		Control	Persistent shock
	Growth of total household credit	Growth of disposable income	Growth of total household credit	Growth of disposable income	Overnight rate[a]	Effective household borrowing rate[b]	Overnight rate	Effective household borrowing rate[b]	Rate	Rate
2012Q1	4.7	3.9	4.7	1.1	100	490	100	493	7.4	7.4
2012Q2	5.3	3.8	5.3	3.8	100	473	100	477	7.4	7.4
2012Q3	5.3	3.8	5.3	3.8	109	461	100	462	7.4	7.4
2012Q4	1.0	3.8	1.0	0.0	122	465	100	497	7.4	8.2
2013Q1	1.0	3.8	1.0	0.0	131	467	100	533	7.4	8.9
2013Q2	1.0	3.8	1.0	0.0	143	471	100	569	7.4	9.7
2013Q3	1.0	3.8	1.0	0.0	148	472	100	607	7.4	10.4
2013Q4	2.5	3.8	2.5	2.0	152	473	100	609	7.4	10.4
2014Q1	2.5	3.8	2.5	2.0	155	473	100	611	7.4	10.4
2014Q2	2.5	3.8	2.5	2.0	158	473	100	613	7.4	10.4
2014Q3	2.5	3.8	2.5	2.0	160	473	100	614	7.4	10.4
2014Q4	2.5	3.8	2.5	2.0	162	472	100	616	7.4	10.4

a. Based on market expectations of the 1-week rate in late April 2012
b. See Box 1 for an explanation of the effective household borrowing rate.

The control scenario (**Table 1**) represents a stable macroeconomic environment in which the unemployment rate and the duration of the period of unemployment are unchanged throughout the simulation period. A gradual increase in the overnight rate is assumed, but the effective borrowing rate declines slightly as some fixed-rate mortgages are renewed at current rates (which are lower than the previous rates on the maturing debt of some households).

In the other scenarios, unemployment increases by 3 percentage points, and the average duration of unemployment rises by six weeks (similar to the assumptions used in past FSR stress-testing exercises, but in a multi-year context). Under the scenario with a short-lived unemployment shock, unemployment rises for only one year and then returns to control. In the persistent-shock scenarios (both with and without asset dynamics), unemployment increases gradually but remains elevated (**Table 1**). Under the persistent-shock scenario with asset dynamics, the prices of stocks and mutual funds decline from their starting point by a cumulative total of 28 per cent and 20 per cent, respectively.[13] Given that near-cash assets are largely unaffected, the total average cumulative effect of a change in asset prices in this scenario is a decline of about 15 per cent in household financial wealth.[14] Aggregate annual savings in all scenarios are kept at about 3 per cent of disposable

Chart 2: The average duration of periods of unemployment: Assumptions



13 These figures reflect a market return that is comparable with the average of the five worst peak-to-trough declines in the Toronto Stock Exchange since the late 1980s.

14 The average return of -15 per cent on total financial assets is a weighted average of returns on individual classes of financial assets, with weights given by the aggregate holdings in household portfolios.

income.[15] The shock scenarios hold the policy rate constant to permit an assessment of the impact of these shocks on household vulnerability in the absence of mitigating policy actions. Nonetheless, the effective household borrowing rate increases in response to a rise in risk premiums of about 220 basis points.[16]

While HRAM does not explicitly model the spillover effects between the financial and real sectors, judgment can be used to incorporate this facet into the design of the scenario. For example, in the persistent-shock scenario shown in **Table 1**, weaker labour market conditions are accompanied by a tightening in lending standards that leads to higher risk premiums, a significant moderation in credit growth and lower house prices. These changes in financial conditions result in weaker growth in household spending and therefore amplify the decrease in aggregate income. These real-financial linkages can be implicitly captured in the scenario by choosing suitably severe assumptions for the unemployment rate and income growth.[17]

Simulation results

Under the control scenario, the share of vulnerable households (**Chart 3**), their share of debt (**Chart 4**) and arrears (**Chart 5**) are all broadly unchanged.

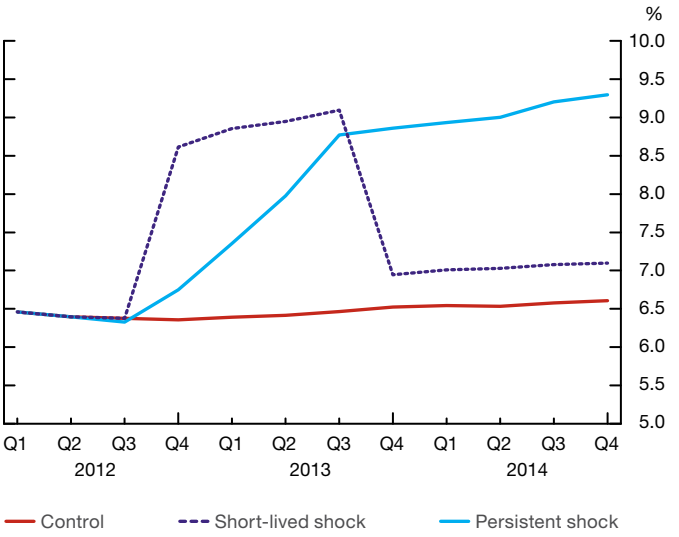
Increases in unemployment lead to greater vulnerabilities and arrears. Although the short-lived unemployment shock leads to a sharp rise in the two vulnerability measures and loans in arrears, most of these effects are temporary. These measures nonetheless return to a level that is somewhat higher than the control case as some households renew fixed-rate mortgages during the higher-rate period of the shock. For the two variants of the persistent-shock scenario, both measures of household vulnerability rise to a higher level, as do loans in arrears. The key difference in the results given by these scenarios is that loan arrears are lower when asset dynamics are allowed (**Chart 5**). This is explained in more detail below.

These results illustrate the key improvements in HRAM. Unlike the previous version, HRAM can now describe arrears over the entire simulation. The total effect of excluding asset dynamics from the shock scenario can be seen by comparing the green and blue lines in **Chart 5**. The green line shows the persistent-shock effect when there are no household savings from current income or returns on financial assets, while the blue line does account for these features. The net effect of asset dynamics is to mitigate the rise in arrears, indicating that the asset-price channel is dominated by the savings channel.

The relatively small impact of financial asset prices in the model can be explained by examining the balance sheets of households that go into arrears. These households typically start with low levels of assets that

Chart 3: Share of vulnerable households

Households with a debt-service ratio ≥ 40 per cent



Source: Bank of Canada calculations

Chart 4: Share of debt held by vulnerable households

Percentage of total debt held by households with a debt-service ratio ≥ 40 per cent

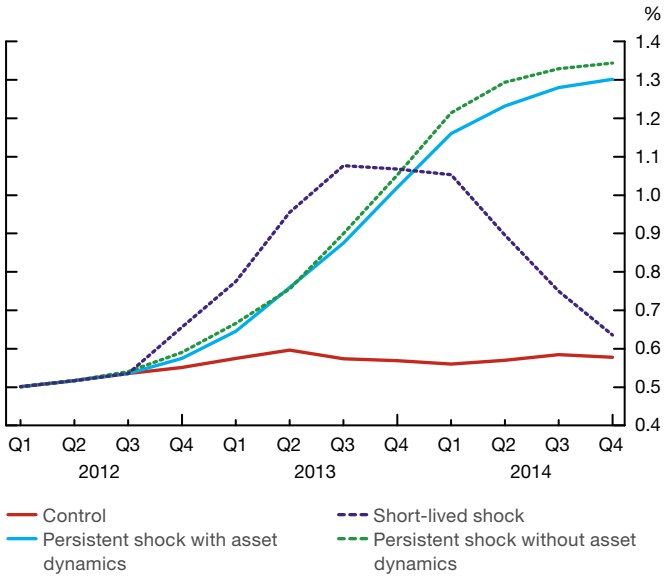
Source: Bank of Canada calculations

15 Generally, the savings rate would increase as unemployment rises, as households become more precautionary. Keeping the savings rate unchanged excludes this mitigating effect.

16 The effective borrowing rate shown in Table 1 rises by less than the risk premium because only a fraction of fixed-rate debt is renewed in each period.

17 A longer-run objective for the development of HRAM is to model the real-financial linkages more formally.

Chart 5: Rate of household loans in arrears



Source: Bank of Canada calculations

are generally in the form of less-risky investments and, therefore, are little affected by changes in equity prices. Conversely, households with high levels of risky assets also tend to have high levels of near-cash liquid financial assets (e.g., money market funds or savings accounts), which are largely unaffected by an asset-price shock. Even a significant shock is unlikely to push them into immediate distress.[18] Together, these facts show why movements in asset prices have a subdued impact on loan arrears in HRAM. On the other hand, relatively modest levels of savings can help to prevent financial distress for the most at-risk groups.

Sensitivity Analysis and Historical Evaluation

In this section, we outline two exercises that were conducted to assess whether HRAM yields reasonable results. First, we examine the sensitivity of the model to changes in the key assumptions for the scenarios. We then run a stylized scenario to evaluate the model's response to a historically extreme macroeconomic downturn.

Sensitivity analysis

For the sensitivity analysis, we modify the unemployment and interest rate assumptions without making any further changes to the other assumptions in the control scenario.[19] **Table 2** summarizes the impact of these changes on the rate of loan arrears by the third year of the simulation. The effect on arrears is somewhat greater than the proportional change in unemployment; for example, a 2-percentage-point increase in unemployment corresponds to an 85 per cent increase in arrears, relative to the most recent historical observation of 0.5 per cent in 2011Q4. The multi-year unemployment shock leads to a cumulative financial strain on households, contributing to the greater-than-proportional effect. Overall, the exercise confirms the significance of unemployment in driving arrears.

The impact of a given increase in interest rates becomes more pronounced when it is combined with higher unemployment. In the most extreme example shown in **Table 2**—where unemployment rises by 6 percentage points and household borrowing rates increase by 400 basis points—the rate of arrears almost quadruples, to a level of about 2.0 per cent (a 290 per cent increase from the starting point of 0.5 per cent).[20] While credit growth would, in reality, slow down in response to the change in interest rates, we would still expect the increase in arrears to be significant, given the severity of the scenario.

Table 2: Percentage increase in arrears as a result of changes in unemployment and interest rates[a]

Unemployment (percentage points)	Interest rates (basis points)		
	+0	+200	+400
+0	15	34	50
+2	85	111	141
+4	136	176	215
+6	191	221	290

a. Measured as the average effect in the third year, relative to the starting-point arrears of 0.5 per cent, with other assumptions taken from the control scenario

The model's response to a 1980s-style recession

We use the recession that occurred in the early 1980s as the basis for our historical model-evaluation scenario. To test the model, we specify a shock that is similar to

18 Despite this observation, the longer-term financial well-being of Canadians could still be significantly affected by such a shock.

19 Assumptions are modified in parallel shifts relative to the control scenario. For example, if unemployment is increased by 2 percentage points (all other assumptions held at control scenario), then the unemployment rate would be higher by this amount (relative to control) for each period of the simulation.

20 We expect that this figure should be well below the 7 per cent to 8 per cent rate of arrears seen in the United States since 2009. Before the crisis, from 1999 to 2006, loans in the United States that were 90 days or more in arrears represented, on average, 2.2 per cent of the total loan balance, more than five times higher than comparable figures for Canada. Stronger provisions for lender recourse in Canada contribute to this difference. In addition, the distribution of the financial profiles of homeowners in the United States had more pronounced vulnerabilities, owing to the expansion in subprime lending.

that episode, and then examine whether the simulated rate of loan arrears is broadly comparable with the level observed then (i.e., a peak of about 1 per cent). The scenario includes an increase in unemployment of 6 percentage points, and household borrowing rates that peak at 21.0 per cent. The impact of a given shock on arrears will vary over time, depending on the underlying vulnerabilities at the time of the shock. Since the current distributions across households of key determinants of vulnerability (e.g., asset levels and the DSR) are much different from those observed in the 1980s, we make adjustments so that these conditions are broadly representative of the earlier period. For example, we rescale debt levels to reflect the fact that the aggregate debt-to-income ratio was much lower (close to 80 per cent) in the early 1980s.

In this scenario, the model predicts that loan arrears would peak at about 1.2 per cent. Available data on arrears for the early 1980s—which are restricted to uninsured mortgages—show a peak of just above 1.0 per cent. Since the peak would likely have been somewhat higher if the historical data included consumer debt and insured mortgages, the model is able to broadly generate the level of arrears experienced during this recession.

The results highlight the importance of starting-point distributions for the DSR and liquid financial assets. Using the current distributions without any adjustments, a similar 6-percentage-point increase in unemployment, as well as higher interest rates, would lead to a significantly greater increase in arrears (**Table 2**).

Conclusion

Stress tests using microdata are a significant component in the assessment of the financial stability risk related to household balance sheets. While aggregate measures can describe important sectoral trends, it is at the micro level that we can better assess the potential change in loan arrears under an adverse-shock scenario.

This report highlights the methodological advances made by the Bank with respect to its stress-testing framework for household financial stability. These include adding the capacity to simulate a multi-year integrated unemployment shock and allowing household assets to evolve over the simulation. The sample scenarios used in this report are illustrative only; the revised stress-testing framework has the flexibility to consider a broader array of alternative assumptions, allowing for an improved assessment of household vulnerabilities.

Further extensions to HRAM are planned to strengthen the empirical foundation of the scenario design. A key example is to base the assumed path for credit growth more closely on empirical findings on the relationship between credit and such variables as interest rates, income and house prices, rather than on judgment. As well, the method of implementing the unemployment shock will be revisited. Currently, unemployment is distributed randomly across all employed households without incorporating household-specific factors into the distribution. Finally, the behavioural detail in the model could be further extended. For example, the simulation does not currently allow distressed households to sell their houses. If they are allowed to do so, they can potentially avoid default, leading to lower arrears. This extension would need to consider how the feasibility of this option would change in a severe housing-market downturn with falling house prices and slower market turnover.

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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>.

AMF: Autorité des marchés Financiers

BCBS: Basel Committee on Banking Supervision

CCP: central counterparty

CDCC: Canadian Derivatives Clearing Corporation

CDCS: Canadian Derivatives Clearing Service

CDSX: Canada's central securities depository and securities settlement service

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

CMG: crisis-management group

CPSS: Committee on Payment and Settlement Systems

DIP: debtor-in-possession

DSR: debt-service ratio

EC: European Commission

ECB: European Central Bank

EFSF: European Financial Stability Facility

ESM: European Stability Mechanism

EU: European Union

FI: financial institution

FSB: Financial Stability Board

G-20: Group of Twenty

GDP: gross domestic product

G-SIFI: global systemically important financial institution

HRAM: Household risk assessment model

IMF: International Monetary Fund

IOSCO: International Organization of Securities Commissions

LDI: liability-driven investment strategies

LTRO: long-term refinancing operations

LVTS: Large Value Transfer System

MLS: Multiple Listing Service

OSC: Ontario Securities Commission

OSFI: Office of the Superintendent of Financial Institutions

PCSA: Payment Clearing and Settlement Act

REO: real estate owned

RMB: Chinese renminbi

S&P: Standard & Poor's

SIFI: systemically important financial institution

TSX: Toronto Stock Exchange

VIX: ticker symbol for the Chicago Board Options Exchange Market Volatility Index