BANK OF CANADA
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Financial System Review—2019

A stable and efficient financial system is essential for sustaining economic growth and raising living standards. In our *Financial System Review*, we identify the main vulnerabilities and risks to financial stability in Canada and explain how they have evolved over the past year.

Browse previous versions of the *Financial System Review*.

Summary

Progress on two key vulnerabilities

The vulnerabilities associated with high household debt and imbalances in the housing market have declined modestly but remain significant.

1. The combined effect of mortgage stress tests and past increases in interest rates has slowed household borrowing and improved the quality of new mortgage lending. The share of Canadians falling behind on their debt payments remains relatively low and steady.
2. Housing resales and price growth have slowed significantly in Toronto and Vancouver over the past two years. Provincial housing measures, mortgage stress tests and past increases in interest rates have helped reduce excesses in these markets. Difficulties in the oil sector continue to weigh on housing markets in oil-producing provinces.

Despite this progress, we need to remain vigilant as the overall level of indebtedness continues to be high, with a large portion of that debt held by highly indebted households.

> New measures have curbed borrowing, reduced speculative behaviour in housing markets and made the financial system more resilient. While the fundamentals in the housing sector remain solid overall and the sector should return to growth later this year, we continue to monitor these vulnerabilities closely.
>
> *Governor Stephen S. Poloz*

See Governor Poloz's opening statement and press conference.

Fragile corporate debt funding emerging as a vulnerability

Across many countries, including Canada, companies have become more indebted. This increase has been concentrated in lower-rated firms. Investor appetite for high-yield bonds and leveraged loans has driven this increase in borrowing, thus making future activity susceptible to shifts in investor sentiment. We will be monitoring this closely.

Other vulnerabilities highlighted in the 2019 *Financial System Review* include the following:

- cyber incidents that could spread across the financial system
- the rapidly changing crypto-asset and fintech sectors
- climate change

Assessing climate-related risks

We want to better understand the risks that climate change poses to the economy and financial system. To do this, we are beginning a multi-year research effort and plan to

- collaborate with domestic and international partners to build our analytical capacity, and
- integrate climate-related risks into financial stability analysis.

The Bank of Canada will publish this work on the Financial System Hub and as part of the *Financial System Review*.

Risk slightly higher, but the system remains resilient

The overall risk to the Canadian financial system has increased slightly since our last assessment in June 2018. This increase is due to a slowdown in economic growth, caused in part by global trade policy uncertainty, last year's oil price decline, ongoing difficulties in the energy sector and expanded risk taking in global financial markets.

The most important risks to Canada's financial system remain a severe nationwide recession, a large house price correction and a sharp repricing of risk in financial markets. A recent stress test conducted by our staff considers these risks and finds that if they materialized, large Canadian banks would be well positioned to manage them, which in turn would mitigate the effects on the wider financial system. At the same time, a second stress shows a scenario in which a material rise in interest rates would result in large redemptions in corporate bond mutual funds, causing a material widening in corporate spreads, which may exacerbate liquidity conditions.

Overall, the financial system remains resilient, and confidence among market participants continues to be high.

> Global uncertainty is rising, and risks to financial stability have edged up in the past year. Still, confidence in the resilience of Canada's financial system remains high, and we are seeing improvements in some of the key vulnerabilities we've been worried about for many years.
>
> *Governor Stephen S. Poloz*

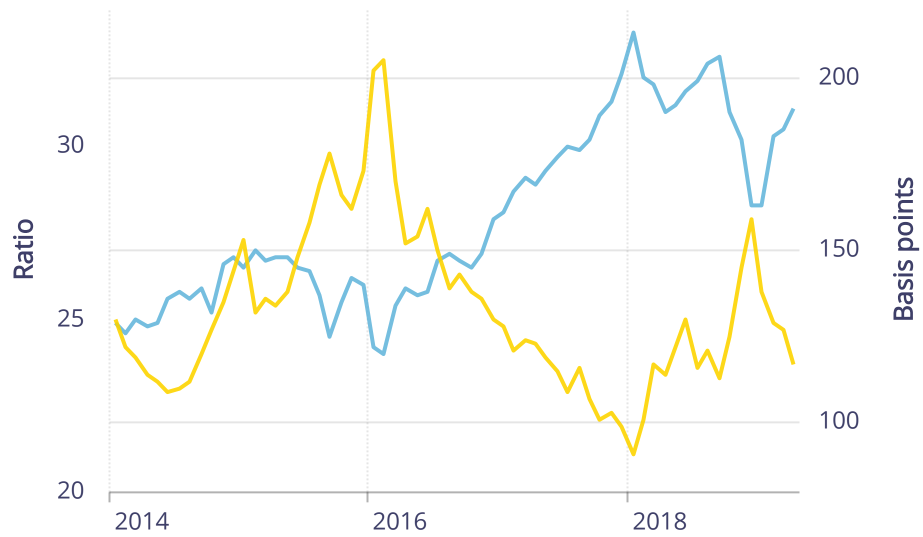
Macrofinancial conditions

» Global financial conditions remain accommodative after a brief tightening at the end of 2018. High leverage leaves the global financial system vulnerable to large adverse shocks.

Global financial conditions have returned to the accommodative levels that prevailed in mid-2018. Low interest rates and optimism about global growth supported risk appetites and asset valuations through much of last year. However, as trade tensions heightened and global growth slowed late in the year, investors became more concerned about the prospects for global economic activity and corporate earnings. In this context, market unease about the pace of monetary policy tightening in some economies also contributed to the deterioration in market sentiment. Equities and other major risky asset classes saw price declines (Chart 1). In the United States, issuance in the leveraged loan and corporate bond markets dropped dramatically as spreads widened, while bond and loan investment funds experienced large outflows. Yields on longer-term government bonds fell (Chart 2).

In early 2019, many major central banks removed the tightening bias in their policy communications in response to growing downside risks to economic growth. Increased uncertainty about trade negotiations and the tightening in market conditions were cited as sources of downside risk. The new tone contributed to a rebound in risky asset prices and further declines in yields on longer-term government bonds. The Government of Canada five-year bond yield fell to levels last seen two years ago. Consistent with this decline, Canadian bank funding costs fell, and rates on five-year, fixed-rate mortgages declined to around 3.2 per cent.

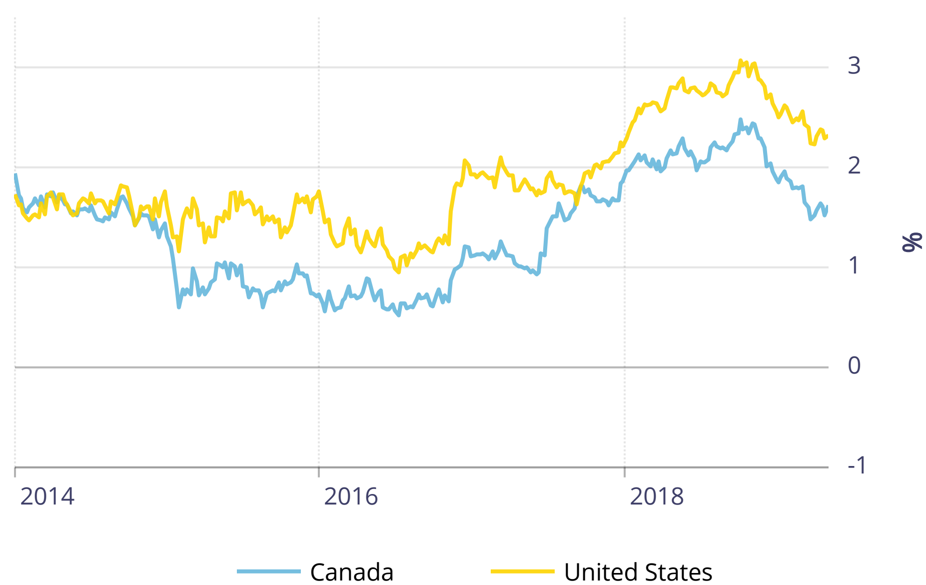
Chart 1: Asset prices and spreads have returned to their levels of a year ago



Sources: Bank of America Merrill Lynch, Bloomberg Finance L.P. and Online Data Robert Shiller
Last observation: April 2019

Chart 2: Five-year government bond yields have declined from recent peaks

Yields to maturity on five-year sovereign bonds



Source: Bloomberg Finance L.P. Last observation: May 3, 2019

Accommodative global financial conditions support near-term growth but may also allow vulnerabilities to build:

- Aggregate debt relative to gross domestic product (GDP) for non-financial corporations is near historic highs in advanced economies.
- Government borrowing is still elevated following past rounds of fiscal stimulus.
- In many countries, the household sector is heavily indebted.
- Financial risk taking has broadly increased, and the creditworthiness of some borrowers has worsened.

In these conditions, a sudden and sharp repricing of credit risk could put pressure on borrowers. This leaves the global financial system vulnerable to large economic and financial shocks.[1]

Vulnerabilities in the Canadian financial system

Vulnerability 1: Elevated level of household indebtedness

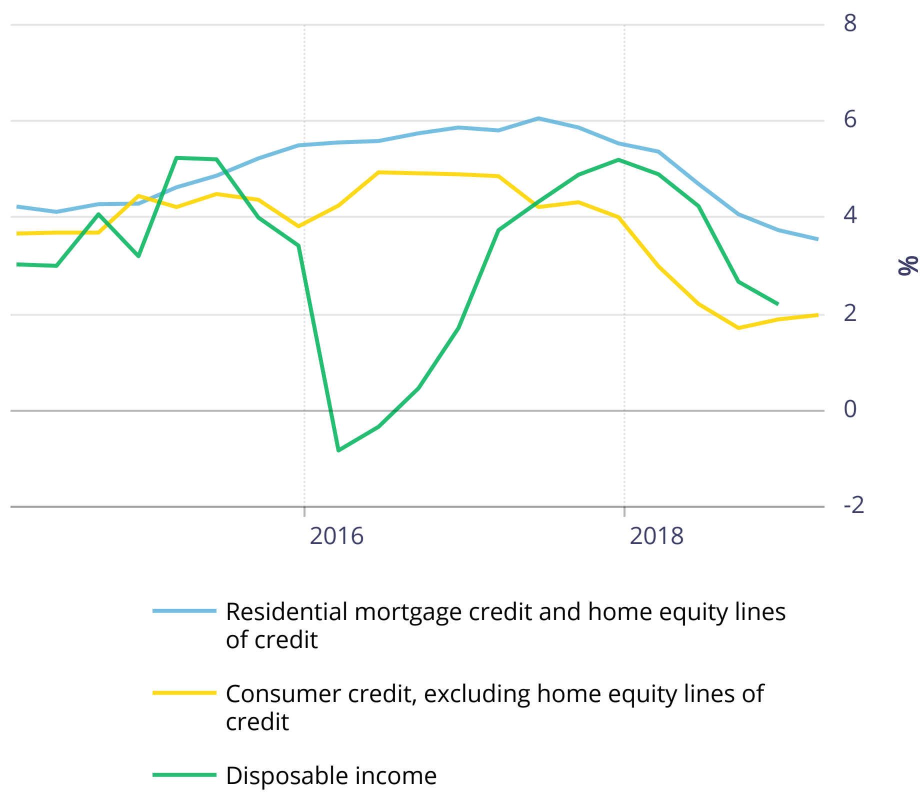
» Highly indebted households are those that have a lot of debt relative to their income. They have less flexibility to deal with sudden changes, such as a decline in income or in the price of their home. When many households are highly indebted, the effects of negative shocks on the financial system and the economy are greater.

» Overall, the vulnerability associated with high household indebtedness remains significant, although it has declined modestly. As households adjust to changes in mortgage policies and past increases in interest rates, the pace of borrowing has slowed and the quality of new mortgages has improved. Nonetheless, a large amount of debt in Canada is held by highly indebted households.

Credit growth has slowed notably since 2017, bottoming out recently at about 3.3 per cent. The slowdown is evident in both real-estate and consumer lending (Chart 3). Real-estate lending includes home equity lines of credit, which contracted in 2018, according to new data from banks.[2]

Chart 3: Household credit growth has moderated

Year-over-year growth

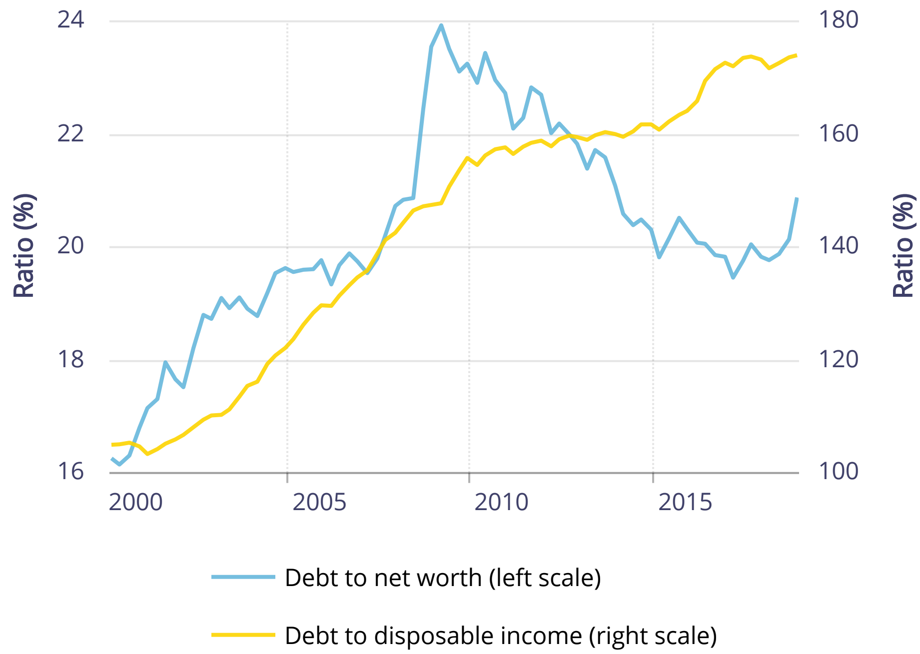


Sources: Statistics Canada and Bank of Canada calculations

Last observations: credit series, 2019Q1; disposable income, 2018Q4

Household indebtedness, as measured by the ratio of debt to disposable income, remains high. It has been relatively stable because income growth has slowed along with credit growth (Chart 4). In contrast, after having declined for nearly a decade, household debt as a percentage of net worth has recently increased due to slower growth in house prices. Box 1 further discusses long-term trends in household net worth, indebtedness and vulnerabilities.

Chart 4: The ratio of debt to disposable income is stable, while debt to net worth has increased recently



Sources: Statistics Canada and Bank of Canada calculations

Last observation: 2018Q4

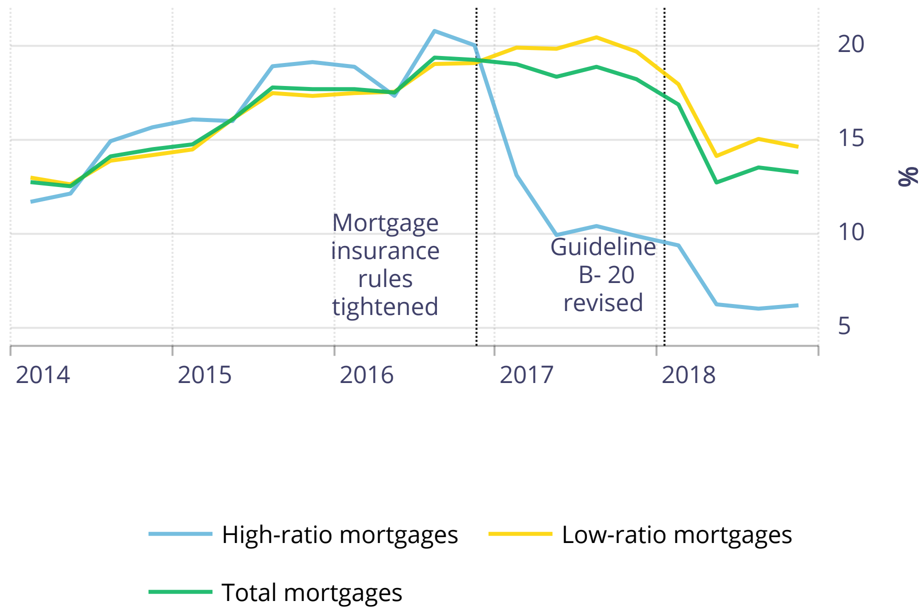
The quality of new mortgage borrowing has improved, but a large amount of debt in Canada is held by highly indebted households. The share of new mortgage lending to households with a loan-to-income ratio greater than 450 per cent fell to a new, lower level (Chart 5). This decline is due in part to tighter mortgage regulations, including a stricter stress test for mortgage interest rates.[3] Some households responded by

- buying a less expensive home,
- delaying their purchases to save more for a down payment, or
- obtaining a loan from a lender that does not apply the stress test.

These regulatory changes increase the resilience of the financial system by making it more likely that new borrowers could handle their mortgage payments even if interest rates rise or their incomes decline. The amount of debt held by highly indebted households, however, remains high and is expected to decline slowly as debt gets paid down and incomes grow.

Chart 5: The share of mortgages going to highly indebted households has stabilized at a lower level

Share of new mortgages with a loan-to-income ratio greater than 450 per cent



Notes: Data include purchases and refinances originated by federally regulated financial institutions. High-ratio mortgages have a loan-to-value ratio greater than 80 per cent and must be insured. Low-ratio mortgages have a loan-to-value ratio of 80 per cent or less. B-20 is the mortgage underwriting guideline for federally regulated lenders.
Sources: Department of Finance Canada, regulatory filings of Canadian banks and Bank of Canada calculations

Last observation: 2018Q4

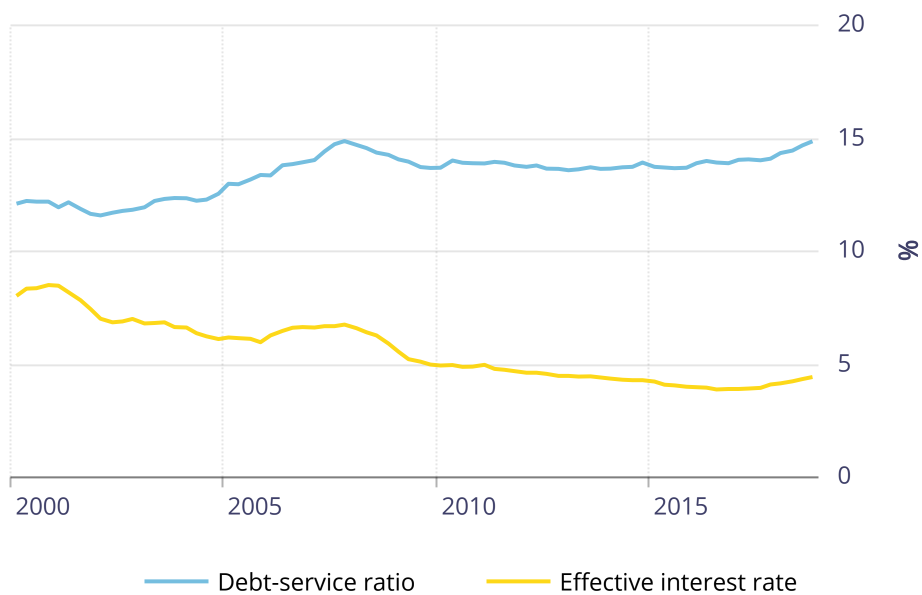
Read more on the Financial System Hub in “The Impact of Recent Policy Changes on the Canadian Mortgage Market”

Households are adjusting to past increases in interest rates. The sensitivity of the economy to higher interest rates has grown because of the rise in household indebtedness and the stricter mortgage interest rate stress tests. As rates rose in 2018, more households were bound by the limits to the debt-service ratio than would have been if the stress tests had not been strengthened.

Until recently, the average debt-service ratio had been relatively stable due to offsetting effects from a steady decline in interest rates and rising indebtedness (Chart 6). Interest rates started to rise in the middle of 2017. The average interest rate for existing debt (the effective interest rate) reached 4.4 per cent by the end of 2018, according to the most recently available data. This led to a rise in the average debt-service ratio, which is at its historic high. Rising interest rates have a more significant impact on highly indebted households, which are already dedicating a greater share of their income to debt payments.

However, since the fourth quarter of 2018, market interest rates on new and renewed loans have declined, leaving Canadians facing less of an adjustment. For example, most borrowers who recently renewed a five-year, fixed-rate mortgage did not see an increase in their mortgage payments.

Chart 6: After being steady for years, the debt-service ratio has recently risen due to higher rates



Note: The debt-service ratio is the ratio of total obligated debt payments divided by disposable income for all households (including those without debt).
Sources: Statistics Canada and Bank of Canada calculations Last observation: 2018Q4

There are ongoing data challenges in assessing vulnerabilities associated with mortgages. For banks and mortgage insurers, the Bank uses extensive loan-level data to assess vulnerabilities. For other mortgage lending, however, it is more challenging to have a complete perspective. Recent improvements, including new data from the Canada Mortgage and Housing Corporation (CMHC) and Statistics Canada, have helped the Bank better understand loans made by credit unions and by mortgage investment corporations (MICs) (Table 1).[4] Despite these improvements, significant gaps remain. For example, the Bank has data on private lending for the Toronto area but not the Vancouver area.

Table 1: Many data sources help assess vulnerabilities in mortgage lending

Source	Coverage	Type of data (all anonymized)
Regulatory filings of Canadian banks	Federally regulated lenders	Loan-level data describing the characteristics of mortgage originations and renewals, including household income and asset values
Mortgage insurers	Insured mortgages from all lenders	Loan-level data as above
Teranet	All lenders, including private lenders, for Ontario properties	Land registry data, including loan sizes, property values and interest rates
	New since the June 2018 *Financial System Review*	
Statistics Canada	Mortgage investment companies	Aggregate national data, currently available until 2017
Canada Mortgage and Housing Corporation	All mortgages from participants in government securitization programs, including uninsured mortgages from credit unions	Loan-level data as above

Federal regulators have tightened underwriting conditions over recent years, including more stringent mortgage interest rate stress tests. This has increased the potential for borrowers to move riskier uninsured mortgages to credit unions and private lenders, including MICs.

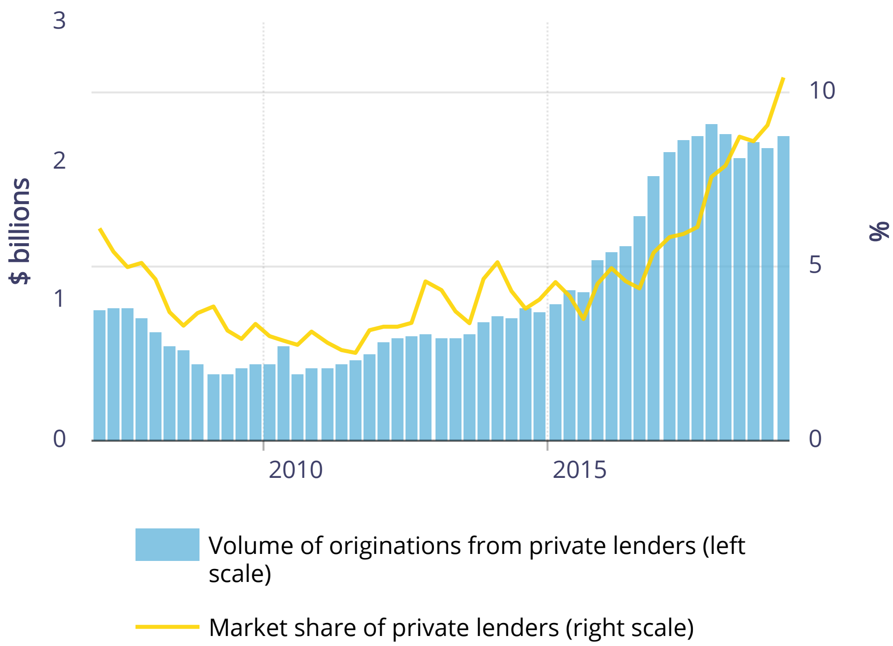
CMHC's initial analysis of its new data does not find significant migration of uninsured mortgages with a high loan-to-income ratio from banks to credit unions.[5] Uninsured mortgages from credit unions represent around 9 per cent of outstanding mortgages in Canada. Roughly half are from caisses populaires in Quebec, which are required to apply a mortgage interest rate stress test that is equivalent to the one applied by banks. Elsewhere, around 60 per cent of five-year, fixed-rate loans from credit unions were subject to a similar mortgage interest rate stress test. For these credit unions, lending to borrowers with a high loan-to-income ratio decreased, as it did for banks.

MICs are a small part of the Canadian residential mortgage market, with a market share of less than 1 per cent of outstanding mortgages.[6] They have, however, grown by about 12 per cent annually over the 10 years ending in 2017, with total assets reaching $13.5 billion. MICs fund their activities primarily through equity offerings. Leverage at MICs is growing but still low, with the equity multiplier (1/equity share) at 1.7, well below their legal limit of between 3 and 6 and much lower than that of the Big Six Canadian banks, at 15 or 16. Furthermore, much of the borrowing is for operating requirements rather than for funding their mortgage portfolios.

MICs are only one type of private lender. Other types of corporations and private individuals make many mortgage loans. Private lending has increased strongly in the Greater Toronto Area, with the volume of new lending doubling between 2015 and 2017. Over the past year, however, it has been relatively stable in contrast to originations by other mortgage lenders, which have declined notably. As a result, the market share of private lenders has continued to rise (Chart 7). This share overstates the importance of private lenders, however, because their loans have shorter terms compared with those of other lenders. As long as their access to capital and leverage remains limited, it will be difficult for private lenders to replace a large portion of the traditional mortgage market.

Chart 7: The market share for private lenders in the Greater Toronto Area continues to grow

Mortgage originations



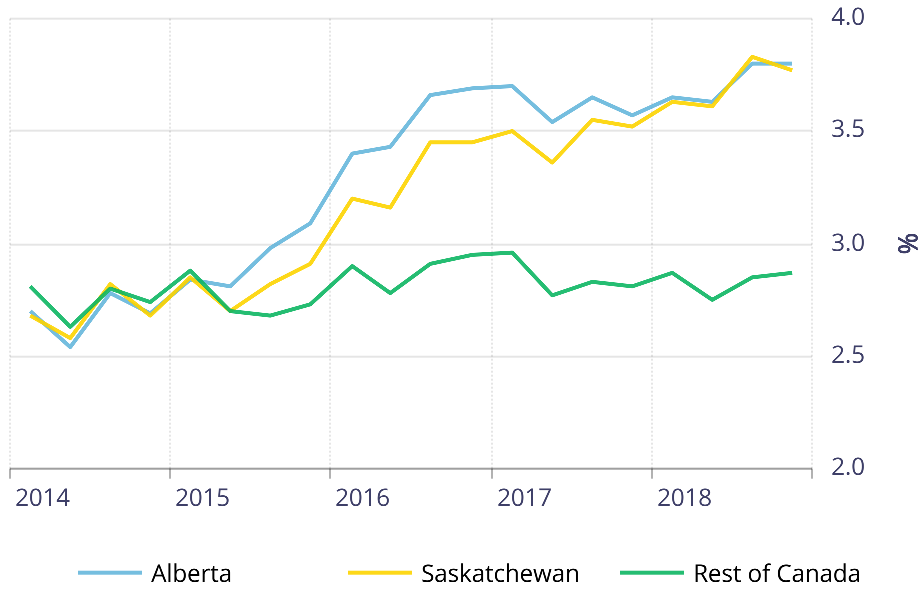
Notes: Originations include purchases, refinances and second mortgages. Mortgage finance companies are not considered private lenders. Volume is seasonally adjusted. Market share is weighted by dollar value.

Sources: Teranet and Bank of Canada calculations — Last observation: 2019Q1

The share of Canadians falling behind on debt payments is low and relatively steady. Outside of the oil-producing provinces, the percentage of households that have fallen behind by 60 days or more on at least one of their credit payments remains stable at about 3 per cent.[7] Alberta and Saskatchewan, however, show a small but steady increase beginning in 2015 after the oil price shock (Chart 8). The impact on the Alberta economy of ongoing adjustment in the oil sector is compounding an already difficult situation for some households.

Chart 8: The share of debtors falling behind on payments is up slightly in oil-producing regions

Percentage of debtors behind on any payment by at least 60 days



Sources: TransUnion and Bank of Canada calculations

Last observation: 2018Q4

Box 1: Net worth, household indebtedness and the vulnerability of the financial system

The rise of debt as a share of income has been well documented in previous issues of the *Financial System Review*. Most of this debt has been used to purchase assets—especially housing, which has increased in value. This strengthened household balance sheets, boosting the median household net worth from $148,000 in 1999 to $296,000 in 2016, in constant 2016 dollars, based on data from Statistics Canada's Survey of Financial Security.[8]

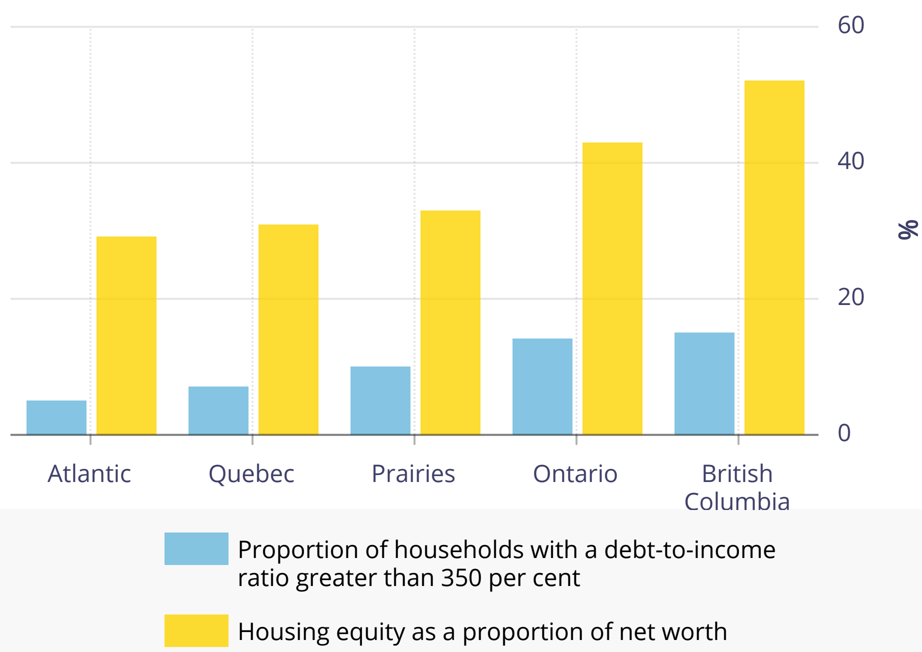
Higher net worth is a sign that the financial position of the median Canadian household has improved. But financial system vulnerabilities can rise even as wealth increases. This is because

- debt and assets are not distributed evenly across households and regions—it matters who holds the debt that finances household assets;
- debt relative to assets does not reflect the ability of households to manage their existing debt obligations within their income; and
- debt endures while asset values fluctuate with market conditions, and the owner might not be able to realize fair value in distressed markets.

While around 30 per cent of Canadian households do not have any debt, about 11 per cent of households have a debt-to-income ratio greater than 350 per cent.[9] As a group, they hold about two-fifths of the outstanding household debt, more than double the share in 1999. The wealth of these households is especially dependent on housing assets. This is evident when comparing financial indicators across regions. Households in British Columbia and Ontario have the highest median net worth, and their net worth is more concentrated in housing (Chart 1-A). These provinces also have the most pronounced imbalances in their housing markets, partially due to investor activity, and are the most indebted as measured by the ratio of household debt to income.

Chart 1-A: Households in British Columbia and Ontario are more indebted, and their net worth is concentrated in housing

2016 Survey of Financial Security



Sources: Statistics Canada and Bank of Canada calculations

In an adverse macrofinancial risk scenario, incomes could come under stress at the same time that house prices decline rapidly. Large debt relative to income diminishes the ability of households to cope financially with a loss in income or rising interest rates. In addition, households with high debt relative to income tend to be younger and more susceptible to job losses during an economic downturn.

Housing assets are a useful buffer against risks only if they can be converted into liquid assets during a period of stress, by refinancing the mortgage or selling the house. But this would be difficult if house prices declined sharply. For example, in a hypothetical national house price decline of 20 per cent, about 42 per cent of borrowers with a debt-to-income ratio greater than 350 per cent would not have enough equity to qualify for refinancing. Selling a house is particularly difficult if many others are doing the same, especially if defaults rise and creditors sell foreclosed homes at distressed prices. This can lead to fire sales with negative effects for the financial system.

Vulnerability 2: Imbalances in the housing market

» When house prices grow at a faster pace than can be explained by economic fundamentals, a price correction that leads to financial stress becomes more likely. This can be serious when buyers are highly indebted.

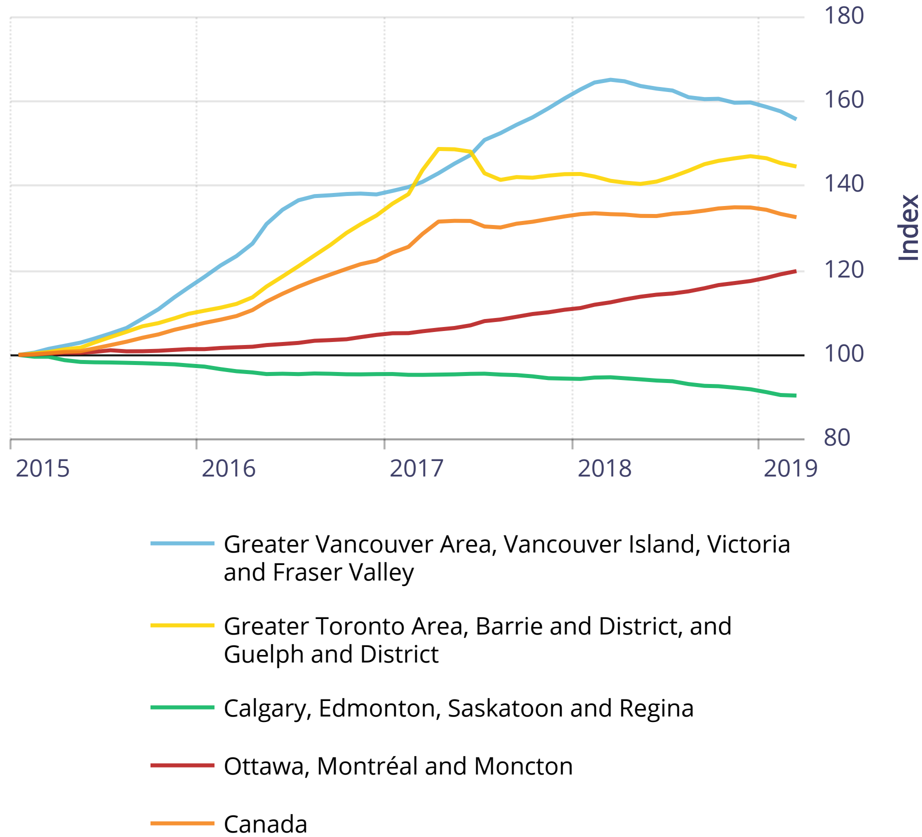
» Overall, imbalances in housing have diminished but remain an important vulnerability. Froth from rising expectations of house price growth has declined in housing markets in the Toronto and Vancouver areas over the past two years. While the Toronto market appears to be stabilizing, prices and resale activity continue to decline in Vancouver. Ongoing difficulties in the oil sector are weighing on housing markets in oil-producing provinces.

Housing resale activity in Canada is down about 20 per cent from its peak in 2016. House price growth has also slowed markedly. For the first time since 2013, it is running below income growth. However, the national data mask diverging regional trends.

Starting in 2015, house prices and resale activity began accelerating in the Toronto and Vancouver areas (Chart 9). This was fuelled, in part, by strong employment and immigration growth, low interest rates and a limited supply of new housing. In turn, expectations of price growth also increased, leading to even stronger demand, including from speculators. At the same time, foreign buyers became increasingly interested in these markets. All this helped reinforce expectations that prices would keep rising rapidly, a situation that was not sustainable.[10]

Chart 9: Regional trends in housing markets continue to differ

Seasonally adjusted benchmark prices (Index: January 2015 = 100)



Note: The lines represent averages of quality-adjusted prices weighted by the population of the corresponding census metropolitan areas as defined by Statistics Canada.
Sources: Canadian Real Estate Association, Statistics Canada and Bank of Canada calculations

Last observation: March 2019

In both markets, expectations have since shifted toward slower price increases and resale activity is lower (Box 2). This coincided with measures introduced by provincial governments to curb the impact of non-resident homebuyers and speculation. Subsequent increases in interest rates and the tightening of mortgage underwriting standards also helped dampen price growth expectations, prices and activity.

The two markets appear to be at different points in their adjustment. After slowing sharply beginning in 2017, the Toronto area appears to be stabilizing, while resales and prices continue to fall in the Vancouver area. Prices in these areas remain 40 to 60 per cent higher than they were four years ago, when prices began to accelerate. This suggests that housing imbalances remain an important macrofinancial vulnerability. But strong fundamentals, including employment growth and supply constraints, support prices.

Previous trends are continuing in other regions. Resales and prices in urban Alberta and Saskatchewan have continued to trend downward. House prices are now about 10 per cent lower than they were at their peak about four years ago, reflecting the regional economic impact of low oil prices.

In contrast, strong employment growth and, according to some reports, increased interest from foreign buyers have contributed to the rise in house prices in the Montréal area. Montréal and several other markets, such as Ottawa and Halifax, remain on solid footing.

The 2019 federal budget introduced new housing affordability measures.[11] The key initiative is the First-Time Home Buyer Incentive. Many of the details have not yet been announced. However, under the three-year, $1.25 billion plan, households with an annual income of less than $120,000 will be eligible for a shared-equity mortgage from CMHC worth 5 per cent of their home price on a resale and 10 per cent for a new build. Mortgage costs are reduced since no interest or principal payments are required on the shared-equity mortgage. When the home is sold, the first-time homebuyer will share their capital gains or losses with CMHC.

Other measures include the following:

- an increase in the maximum amount a first-time homebuyer can withdraw from a registered retirement savings plan to $35,000, up from $25,000;
- an additional $10 billion for the Rental Construction Financing initiative, a program to fund the construction of affordable rental units;
- a Housing Supply Challenge with funding of $300 million; and
- the Expert Panel on the Future of Housing Supply Affordability, jointly established with British Columbia.

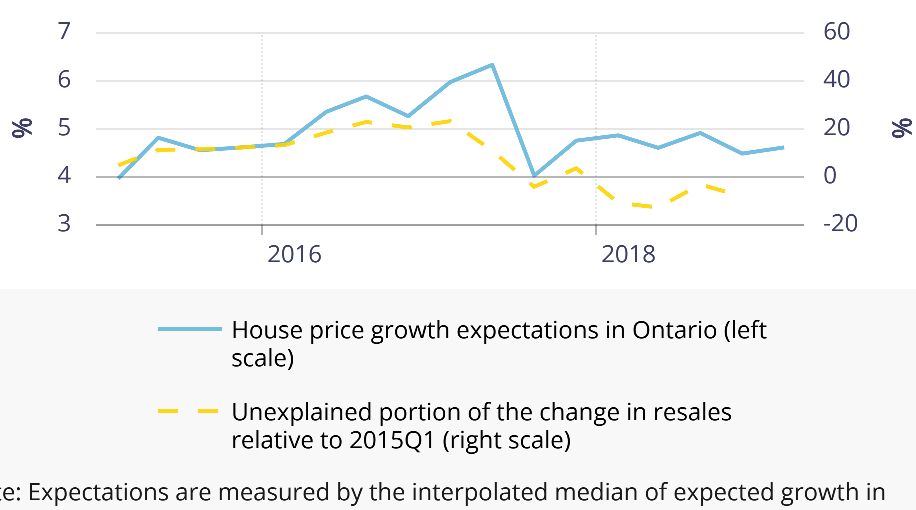
The new measures help address housing affordability and are not expected to significantly affect vulnerabilities. The size and targeted nature of the measures will limit pressures on housing demand, and other elements are designed to boost housing supply. As a result, any increase in prices should be small.[12] The creation of new highly indebted households will be limited by a 400 per cent cap on the allowable loan-to-income ratio. In addition, shared-equity mortgages could act as a modest shock absorber for the economy and the financial system by contributing to the resilience of household balances sheets to a decline in house prices.

Box 2: Housing resales and price expectations in the Toronto area

Rising expectations of house price growth may have increased investor activity and accelerated purchases by consumers with “fear of missing out.”[13] Housing resale activity in Toronto in 2015 and 2016 was much stronger than could be explained by economic fundamentals.[14] The unexplained strength is, however, highly correlated with expectations of house price growth, as measured in the Bank of Canada’s Survey of Consumer Expectations (Chart 2-A).

Expectations for growth in house prices shifted down beginning in early 2017 due to housing policy changes announced by the Ontario government (including a 15 per cent tax on non-resident purchases). Resale activity in Toronto fell a cumulative 38 per cent in the following three months, despite non-residents accounting for less than 10 per cent of purchases. Higher interest rates followed by changes to mortgage underwriting guidelines also weighed on price expectations and resale activity beginning in mid-2017. A similar relationship between price expectations and housing resales can be seen in the data for British Columbia.[15]

Chart 2-A: Price expectations played a key role in the rise and fall in resale activity in Ontario



Note: Expectations are measured by the interpolated median of expected growth in national house prices over the next 12 months for residents of Ontario. See M. Khan and T. Webley, "Disentangling the Factors Driving Housing Resales," Bank of Canada Staff Analytical Note No. 2019-12.

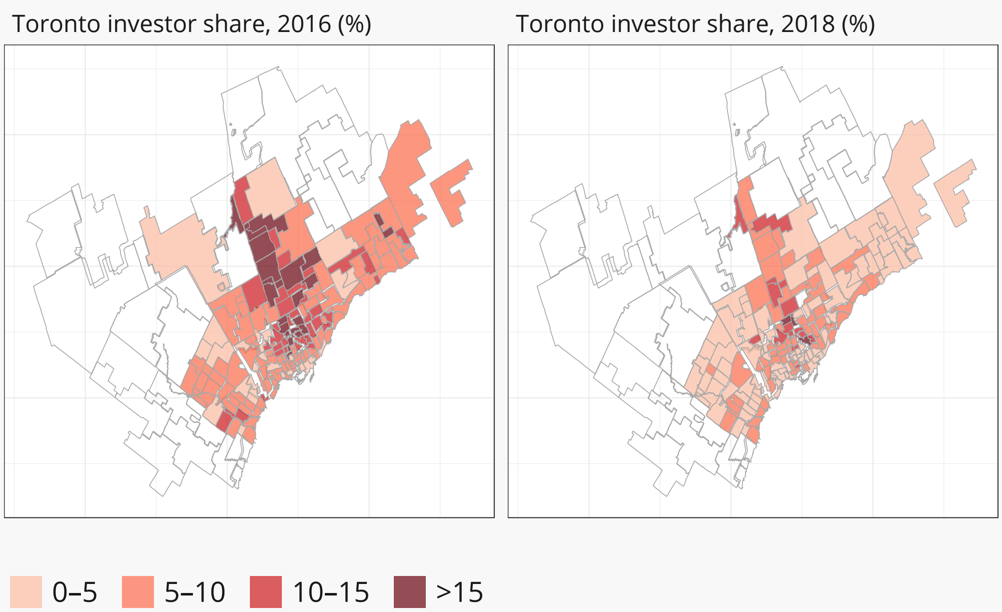
Source: Bank of Canada

Last observations: house price expectations, 2019Q1; deviation of resales, 2018Q4

The period of strong resales in Ontario coincides with an increase in investor activity. Data compiled by Realosophy Inc. on the share of investor purchases (defined as freehold investment properties listed for rent shortly after purchase) in the Greater Toronto Area (GTA) show that in 2016 investors accounted for as much as 1 in 5 resales in certain neighbourhoods and about 1 in 10 resales across the GTA. By 2018, price expectations dropped, investor activity fell significantly, and the share of resales roughly halved (Chart 2-B).

Chart 2-B: The share of investor activity fell markedly in 2018

Share of freehold resales subsequently listed for rent



Source: Realosophy

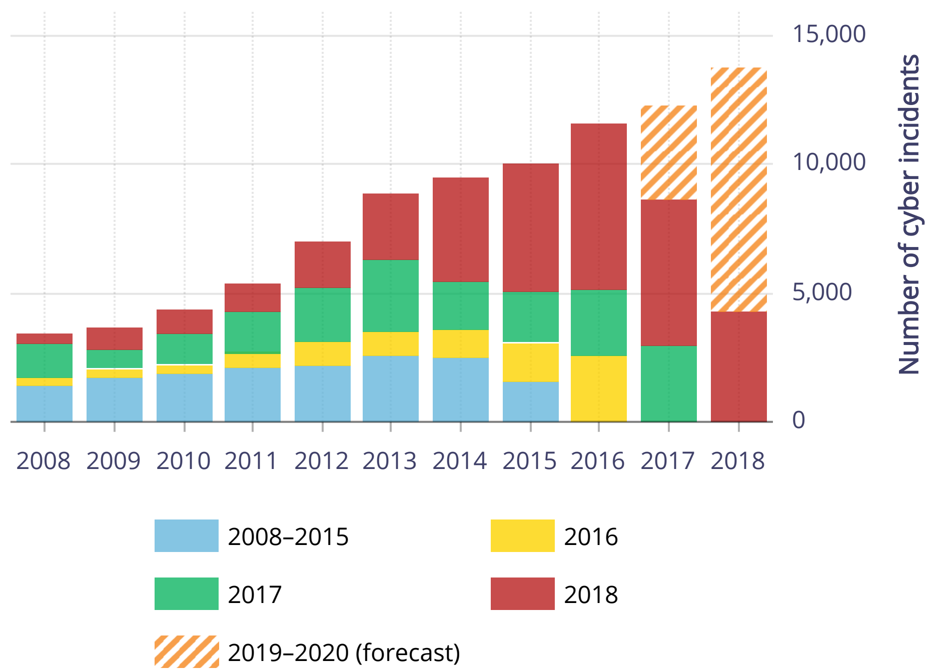
Vulnerability 3: Cyber threats and financial interconnections

- A successful cyber attack or other major cyber incident at a financial institution could spread across the interconnected financial system, interrupting the delivery of crucial financial services and damaging investor confidence.
- Cyber threats remain a key structural vulnerability. Federal authorities and financial institutions are making significant investments to strengthen the cyber resilience of the financial system, including through enhanced coordination, collaboration and information sharing. Continued vigilance is needed to maintain security.

Cyber incidents continue to be identified by market participants as the greatest risk to the Canadian financial system, according to the Bank's Financial System Survey. The number of incidents that have or could have resulted in substantial financial losses has increased steadily over the past decade, according to international data on cyber events collected by Advisen from publicly verifiable sources (Chart 10). The finance and insurance sector is the most affected, with more than one-fifth of incidents.

Chart 10: Cyber incidents are rising but take a long time to be visible to the public

Colours correspond to the date that an incident enters the database



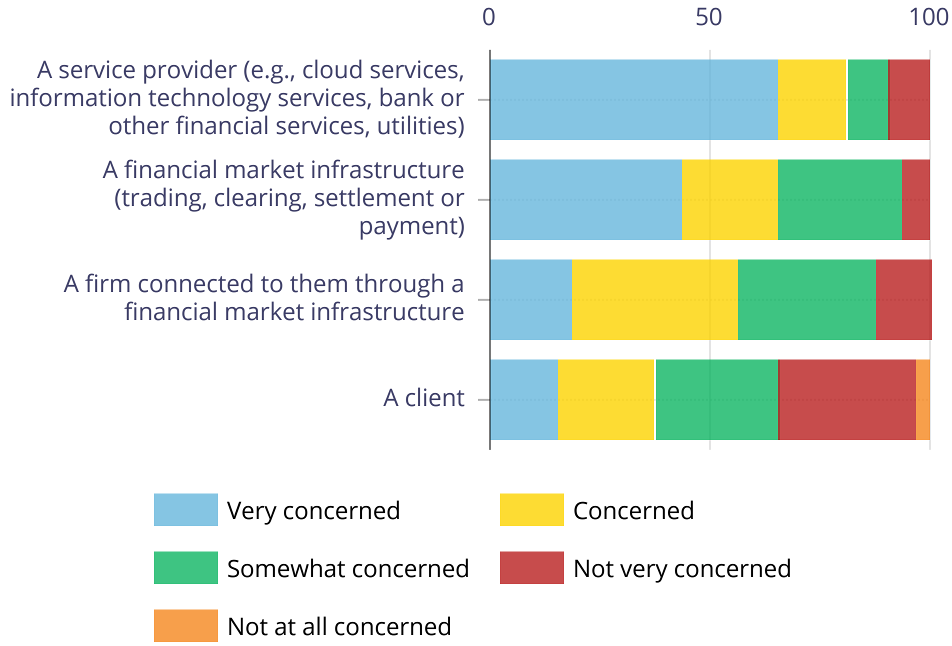
Sources: Advisen and Bank of Canada calculations

Last observation: March 2019

Financial system participants are particularly concerned about cyber incidents at third-party service providers (Chart 11). A key factor driving the concern about cyber threats is the high degree of interconnectedness between financial institutions. This interconnectedness extends to crucial services offered by third parties, including cloud services and utilities. When many financial institutions rely on the same third-party service provider, a disabling cyber incident could have systemic effects. The Bank, the Department of Finance Canada and the Office of the Superintendent of Financial Institutions (OSFI) are members of the G7 Cyber Expert Group, whose work includes managing cyber risk from third parties.[16] Separately, the Bank oversees financial market infrastructures, including their risk management practices. This involves, for example, strengthening expectations for third-party risk management and ensuring that risk management standards limit the propagation of risk across the system.

Chart 11: Survey results point to concerns about third-party service providers

Percentage of respondents



Note: Financial System Survey question: "For the following sources of cyber incidents that could indirectly affect your firm: Assuming the incident materializes over the next two years, how concerned are you that it would severely disrupt your critical activities, functions or processes?"
Source: Bank of Canada Financial System Survey Last observation: Spring 2019

Financial institutions, governments and authorities have been making significant investments to address cyber vulnerabilities. The Bank recently updated its cyber security strategy for 2019–21. In addition to measures that strengthen the Bank's own cyber resilience, the strategy includes several initiatives for the broader financial system. For example, the Bank plans to set out more detailed expectations for how financial market infrastructures would meet the Bank's cyber risk management standards. In addition, the Bank continues its partnership with Payments Canada and the Big Six Canadian banks to enhance the resilience of Canada's wholesale payments system to cyber incidents. The federal government has also been taking action. It established the Canadian Centre for Cyber Security, the RCMP National Cybercrime Coordination Unit and two new federal cyber investigation teams. The government will also introduce legislation to strengthen the cyber resilience of Canada's critical infrastructure.

Coordination and information sharing among private and public sector entities are crucial for improving cyber resilience. As Chart 10 shows, it can take several years for a cyber incident to be visible in public sources. This is because firms can be slow to detect incidents, and it can take a long time to assess their effects. Firms are also reluctant to report incidents. Statistics Canada's 2017 Survey of Cyber Security and Cyber Crime revealed that, of finance and insurance businesses suffering a cyber incident, only 29 per cent reported it to police, 21 per cent reported it to the Canadian Cyber Incident Response Centre,[17] and 3 per cent reported the incident to their regulator.

Without a good understanding of current cyber incidents, it is more difficult to establish good strategies to protect and recover from them. Canadian financial sector authorities are clarifying existing reporting requirements and introducing new ones, including for federally regulated financial institutions, marketplaces, clearing agencies and dealers. The Bank is also reviewing its own requirements for cyber reporting for systemically important financial market infrastructures. These changes will allow better monitoring by authorities, including helping protect other financial system participants who might experience similar incidents.

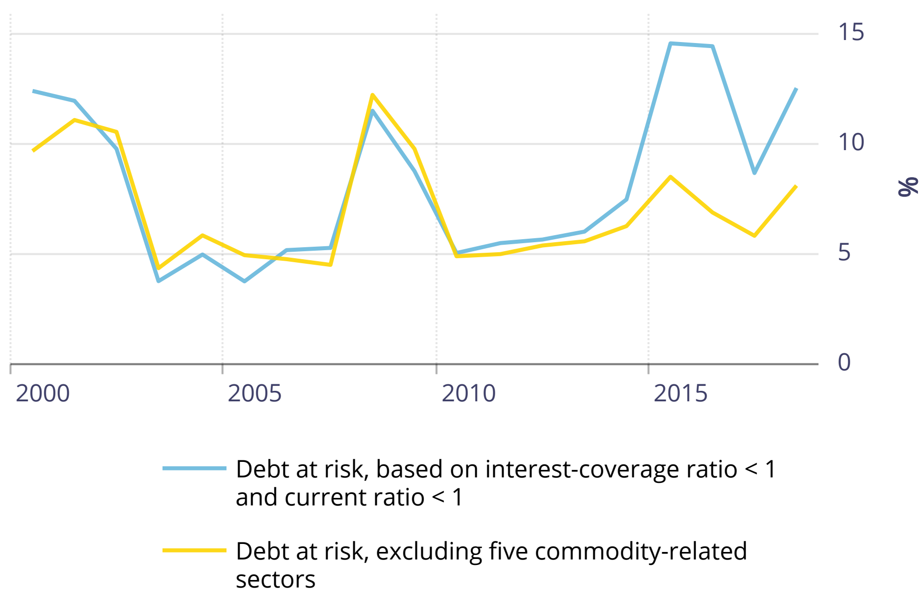
Canadian financial institutions and their authorities are also strengthening relationships with security partners and improving domestic and international communication protocols. One key initiative is the formation of a new public-private partnership in Canada to prepare for and respond to systemic-level operational events, including cyber events. This partnership aims to improve coordination among financial institutions, financial market infrastructures and public authorities. It also provides a forum for collaborating on financial sector-wide resiliency initiatives.

Vulnerability 4: Fragile corporate debt funding from certain markets

- Highly indebted firms with poor debt-service capacity and low holdings of liquid assets have less flexibility to deal with a sudden decline in income or a sharp increase in interest rates. If the providers of this debt are highly leveraged or vulnerable to changing investor sentiment, adverse shocks can lead to important spillovers to the financial system.
- Indebtedness of the Canadian non-financial corporate sector is high, primarily driven by commodity-related sectors. Strong investor demand and deterioration in the creditworthiness of Canadian firms in certain sectors have led to increased reliance on US high-yield bonds and leveraged loans. Borrowers in these markets are increasingly vulnerable to sudden changes in investor sentiment. This emerging vulnerability warrants monitoring.

Corporate indebtedness in Canada is elevated. Non-financial corporate debt relative to income, at 315 per cent in 2018, is well above its historical average.[18] Furthermore, the proportion of outstanding debt owed by firms that have poor debt-service capacity and low liquid asset holdings (debt at risk) is also historically high (Chart 12).[19] A sectoral analysis indicates that the rise in indebtedness and debt at risk has been driven largely by firms in commodity-related sectors, reflecting both higher debt and a sharp decline in income due to lower commodity prices since 2014. At the same time, the average Canadian firm has enough liquid assets and cash to manage a quick rise in interest rates or a sharp decline in income over the near term, suggesting that it has adequate financial flexibility.

Chart 12: Debt at risk is above its historical average due to developments in commodity-related sectors



Sources: Statistics Canada Quarterly Survey of Financial Statements and Bank of Canada calculations

Last observation: 2018Q4

Corporate debt is also rising in many other advanced economies.[20] This trend is taking place in the context of stricter regulatory requirements for banks, which now fund a smaller share of corporate debt. Non-bank credit providers have stepped in, partly motivated by a search for higher returns in the low interest rate environment.[21] In particular, the global market for high-yield debt, which includes high-yield bonds and leveraged loans, has grown significantly and is now larger than it was before the global financial crisis (Box 3). Lending standards have also loosened in recent years, and the quality of corporate debt has deteriorated across many countries.[22] Consequently, investors are more exposed to credit risk and firms are more vulnerable, on average, to a rapid repricing of risk. At the same time, non-bank credit providers have created a more diverse funding pool for firms, which benefits financial stability and efficiency.

Box 3: The global leveraged loan market has grown in size, risk and complexity

Leveraged loans are high-yield syndicated loans provided to non-financial firms, typically with non-investment-grade credit ratings. This market provides funding to riskier firms that otherwise would have difficulty accessing credit on flexible terms. Leveraged loans differ from high-yield bonds in that they are more senior in the firm's capital structure and they generally have floating interest rates.

Banks underwrite most leveraged loans and issue them in US and European markets. They are sold to a wide range of financial system participants (e.g., investment funds and pension funds), and a substantial share is securitized into collateralized loan obligations (CLOs). A CLO is a single security backed by a pool of leveraged loans. CLO structures are subject to tighter regulations than they were before the global financial crisis, including more stringent subordination requirements and restrictions on asset holdings.

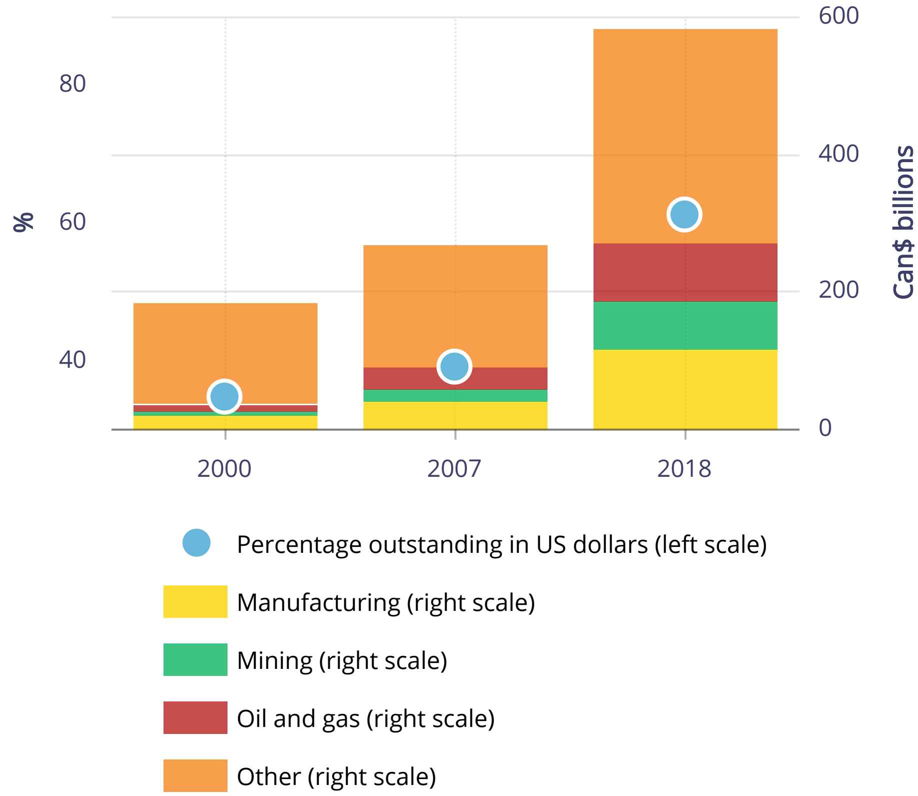
The global leveraged loan market is estimated to have doubled in size between 2011 and 2018.[23] In recent years, credit quality has deteriorated. Covenant-lite loans now represent more than 80 per cent of new loans. These loans contain fewer protections for lenders. This improves flexibility for the borrowers, but it implies that both defaults and losses due to default during a stressed period could be higher than some investors expect based on past performance.

The deterioration of credit quality could contribute to rapid sales by investors in a stress situation. The global leveraged loan market is opaque, with limited information on the ultimate owners of the risk. In addition, most leveraged loans and CLOs are relatively illiquid. If prices drop rapidly, exchange-traded funds and open-ended mutual funds would likely be forced to sell into declining markets because of growing redemptions. Banks could also transmit risk from these markets. Since banks underwrite leveraged loans and may have other exposures to both borrowers and investors, it is important that they incorporate these risks in their risk management frameworks.

Like that in many other countries, the non-financial corporate sector in Canada relies heavily on non-bank credit providers. For example, the amount of bonds outstanding issued by the Canadian non-financial firms increased from $270 billion in 2008 to $580 billion in 2018,[24] with the increase evident across all sectors (Chart 13).

Chart 13: Several sectors have increased their reliance on bond financing

Bonds outstanding, by currency and sector, annual average



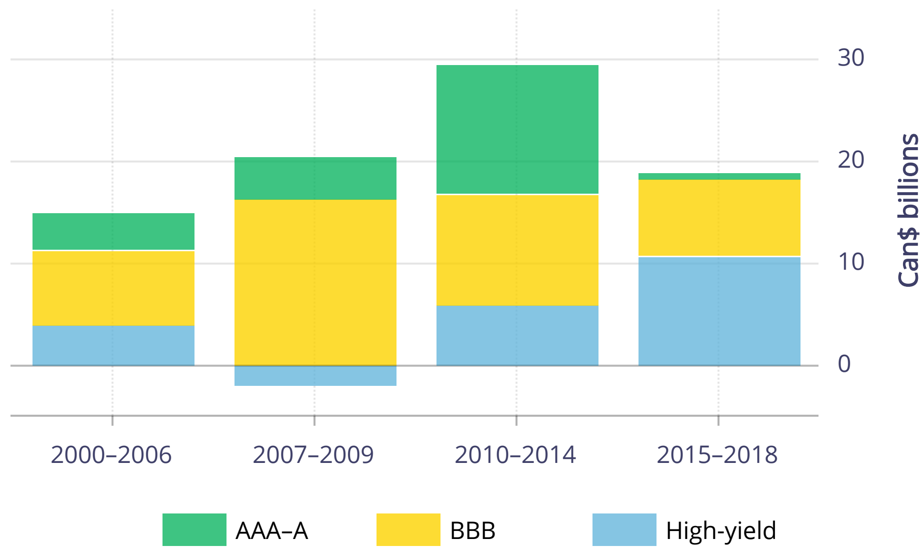
Notes:
1. The data exclude firms in the financial, insurance and management of companies (holding companies) sectors and government-sponsored enterprises.
2. Conversion from US to Canadian dollars is at the exchange rate in effect for each year.
Sources: Refinitiv DataScope Fixed Income data and Bank of Canada calculations

Last observation: 2018Q4

Canadian corporations, particularly firms with a lower credit rating, are increasingly funded in the United States. Over the past four years, the increase in corporate bonds issued by Canadian non-financial corporations has been driven primarily by issuers of lower-quality credit (Chart 14). Because the market for Canadian high-yield bonds is very small, these firms, including many in commodity-related sectors, have issued mainly in the United States. This has helped boost the share of bonds issued in US dollars by Canadian firms from 40 per cent in 2007 to around 60 per cent in 2018.

Chart 14: Increases in outstanding corporate bonds over the past four years have been driven by firms with lower ratings

Annual average



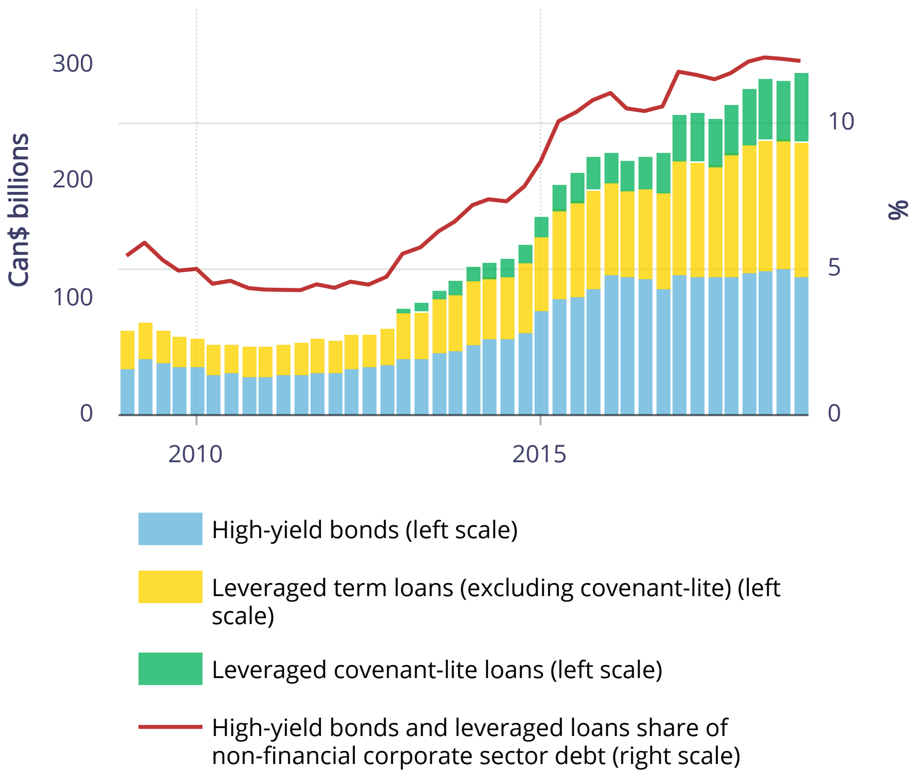
Notes:
1. The data exclude firms in the financial, insurance and real estate sectors and bonds issued in currencies other than US and Canadian dollars.
2. Given that the bond and credit rating data from Refinitiv and Moody's do not cover the entire market, the actual increase in amount outstanding is larger than the estimates provided in the chart.
3. Conversion from US to Canadian dollars is at the exchange rate in effect for each year.
Sources: Bloomberg Finance L.P., Moody's, Refinitiv DataScope Fixed Income data and Bank of Canada calculations
Last observation: 2018Q4

An increasing number of Canadian firms in various industries are also relying on the US leveraged loan market. The outstanding amount of leveraged loans to Canadian non-financial firms has increased over the past four years from Can$80 billion to Can$175 billion. About one-third of these leveraged loans are covenant-lite, compared with one-fifth only four years ago. Globally, the increase in covenant-lite loans is even more pronounced.

Together, the funding from leveraged loan and high-yield bond markets accounts for at least 12 per cent of total non-financial corporate debt (Chart 15).[25] This is 6 percentage points higher than a decade ago. Borrowing in US dollars provides a natural hedge to some Canadian firms due to their business activities. For example, oil and gas firms price their products in US dollars.

Chart 15: Canadian firms are increasingly using US high-yield bonds and leveraged loans

Amount outstanding, quarterly



Notes:
1. The data exclude firms in the financial, insurance and real estate sectors and bonds issued in currencies other than US and Canadian dollars.
2. Given that the bond and credit rating data from Refinitiv and Moody's do not cover the entire market, the actual increase in amount outstanding is larger than the estimates provided in the chart.
3. Conversion from US to Canadian dollars is at the exchange rate in effect for each year.

Sources: Bloomberg Finance L.P., Moody's, Refinitiv DataScope Fixed Income data and Bank of Canada calculations

Last observation: 2018Q4

Borrowers in leveraged loan and high-yield bond markets are vulnerable to changes in investor sentiment. Large shocks that heighten uncertainty or aversion to risk have the potential to destabilize funding. This is especially true when investors are seeking more risk for higher returns, as may be the case in a low interest rate environment. The December 2018 episode of large and rapid redemptions from loan investment and bond funds provides some evidence that these markets are fragile (see the section "Analysis of financial system resilience" for an examination of this effect in corporate bond funds). This episode resulted in an increase in credit spreads and fewer bonds and loans issued. Moreover, persistent problems in these markets could have broader implications for financial stability in Canada through the macroeconomic effects of a decline in corporate funding availability in the United States. Developments in these markets will be especially important as a greater number of leveraged loans and high-yield bonds mature in 2019 and beyond.

Vulnerability 5: Climate change

- Climate change continues to pose risks to both the economy and the financial system. These include physical risks from disruptive weather events and transition risks from adapting to a lower-carbon global economy.
- The Bank is undertaking a multi-year research plan to better assess the risks from climate change that are relevant to its mandate. This work includes collaborating with domestic and international partners, such as with the Central Banks and Supervisors Network for Greening the Financial System (NGFS).

The Bank of Canada is incorporating climate change risk into its analysis of the Canadian economy and financial system. Economic activity and the environment are intertwined. Most experts agree that the global climate is changing and that this has growing implications for the economy. But the range of possible outcomes is large.

Climate change creates important physical risks both in Canada and globally. According to the Intergovernmental Panel on Climate Change, the average world temperature in 2017 was around 1°C higher than pre-industrial levels and is projected to rise by 0.2°C per decade. One consequence is an increase in extreme weather events such as flooding, hurricanes and severe droughts. Insured damage to property and infrastructure in Canada averaged about $1.7 billion per year from 2008 to 2017, up from $200 million per year from 1983 to 1992.[26] Canada is particularly affected—it is estimated to be warming significantly faster than the rest of the world.[27]

The move to a low-carbon economy involves complex structural adjustments, creating new opportunities as well as transition risk. Investor and consumer preferences are shifting toward lower-carbon sources and production processes, suggesting that the move to a low-carbon economy is underway. Transition costs will be felt most in carbon-intensive sectors, such as the oil and gas sector. If some fossil fuel reserves remain unexploited, assets in this sector may become stranded, losing much of their value. At the same time, other sectors such as green technology and alternative energy will likely benefit.

Both physical and transition risks are likely to have broad impacts on the economy. Moving labour and capital toward less carbon-intensive sectors is costly and takes time. Global trade patterns may also shift as production costs and the value of resources change. The necessary adjustments are complex and pervasive and might lead to increased risk for the financial system. In addition to insurance companies, many other parts of the financial system are exposed to risks from climate change. Banks have loans to carbon-intensive sectors as well as to connected sectors—for example, those upstream or downstream in supply chains. Asset managers hold carbon-intensive assets in and outside Canada. The Government of Canada's Expert Panel on Sustainable Finance is studying these issues.

Limited understanding and mispricing of climate-related risks could potentially increase the costs of transitioning to a low-carbon economy. The risks faced by the financial system from climate change can be managed most effectively when investors and authorities know what exposures firms face and how they are being managed. The Financial Stability Board's (FSB) Task Force on Climate-related Financial Disclosures recommends that firms publish climate-related financial information. However, this practice is not universal. Few firms disclose the financial impact of climate change on their assets and operations. Moreover, there are also inconsistencies in how firms report climate-related risks across industries and regions.

In addition, asset prices may not fully reflect carbon-related risk, which could also raise the cost of transitioning to a low-carbon economy. Mispricing might occur for a variety of reasons. These include a lack of information on carbon exposures or incentives that are not properly aligned. Mispricing can also occur because decision makers find it difficult to account for uncertain and complex events in the distant future. If assets are mispriced, correct incentives will not be in place to manage and mitigate risks. Rapid repricing might cause fire sales and interact with other vulnerabilities—like excessive leverage—destabilizing the financial system. Better transparency could help alleviate this risk.

Through research and collaboration with partners, the Bank is improving its understanding of climate risks as they relate to the Bank's mandate. The Bank is working with members of the NGFS. The NGFS's first comprehensive report, released in April 2019, has four non-binding recommendations related to central banks, including the Bank of Canada:

1. *Integrating climate-related risks into financial stability monitoring and micro-supervision.* The Bank will develop the tools needed to monitor and analyze climate-related risks, leading to a meaningful assessment of these risks. One approach is to use scenario analysis.
2. *Integrating sustainability factors into own-portfolio management.* The Bank is considering how to integrate environmental, social and governance factors into its investment framework for the Bank of Canada pension fund.
3. *Bridging the data gaps.* By participating in the NGFS working groups and other groups, the Bank will help identify data gaps. This will help relevant domestic and international stakeholders focus their efforts to improve the availability of data.
4. *Building awareness and intellectual capacity and encouraging technical assistance and knowledge sharing.* The Bank is building its analytical capacity as part of a multi-year research plan. To accelerate the plan's development, the Bank is collaborating with the NGFS and other groups. The Bank plans to publish its work on the Financial System Hub and as part of the *Financial System Review*.

Two other NGFS recommendations do not fall directly within the mandate of central banks but are important to facilitate their work:

5. *Achieving robust and internationally consistent climate and environment-related disclosure*, and
6. *Supporting the development of a taxonomy of economic activities*.

Vulnerability 6: Rapid change in crypto-asset markets

- » Crypto assets are diverse and fast-evolving, posing risk to the financial safety of consumers and investors.
- » Crypto assets do not currently represent a significant vulnerability for the Canadian financial system. They lack the size and, most importantly, the connections with the traditional financial system necessary for large shocks to spread or intensify. But because crypto assets have the potential to create changes in the financial system, monitoring by both domestic and international authorities is crucial.

Crypto assets form a diverse landscape, creating a range of risks. Some crypto assets, such as Bitcoin, were originally designed for making purchases. Although they are often referred to as crypto currencies or crypto money, they lack many of the essential characteristics of money because they make poor media of exchange, stores of value and units of account.[28] Another kind of crypto asset, called a security token, allows buyers to take an ownership interest in an asset. For example, initial coin offerings are sometimes designed to allow buyers to purchase equity in a firm. In contrast, utility tokens give holders the right to consume some product or service associated with a platform.

Looking at the underlying economic characteristics of the different kinds of crypto assets helps authorities monitor and manage risks across the landscape. Both internationally and in Canada, authorities are focused on issues related to consumer and investor protection, market integrity, tax evasion, money laundering and terrorist financing. The intergovernmental Financial Action Task Force provides guidance on how its requirements for combatting money laundering and terrorist financing apply to crypto assets.[29] The Basel Committee on Banking Supervision has published expectations for how banks should manage risks from exposure to crypto assets.[30] And the International Organization of Securities Commissions is focusing on trading platforms for crypto assets and investment funds with exposures to crypto assets. In Canada, Canadian Securities Administrators and the Investment Industry Regulatory Organization of Canada are consulting on developing a framework to regulate crypto-asset trading platforms.[31]

Crypto-asset markets continue to pose little threat to the stability of the financial system. A significant fall in crypto-asset prices has shrunk the overall size of these markets, and the use of initial coin offerings to raise funds has declined sharply in the past year. In addition, exposures of financial institutions to crypto-asset markets remain small.

But crypto-asset markets and other uses of the underlying distributed ledger technology continue to change quickly. Implications for financial stability might arise rapidly. The FSB has developed a framework to monitor crypto-asset markets for possible development of financial stability risks.[32] In Canada, federal and provincial authorities have set up a working group to monitor the crypto-asset markets. The group is chaired by the Bank of Canada and includes representatives from the Heads of Regulatory Agencies, the Financial Consumer Agency of Canada, the Financial Transactions and Reports Analysis Centre and the Canada Revenue Agency.[33]

Recent investor losses at crypto companies—in Canada and other countries—reinforce the need for investor awareness and caution. The failure of QuadrigaCX—a crypto exchange—and a fraud investigation targeting an initial coin offering by consulting firm Vanbex are evidence of weak governance. This creates substantial risks for investors in crypto assets. Investors and consumers must take primary responsibility for understanding the full range of risks before participating in these markets.

Read “A Perspective on Crypto ‘Money’” on the Financial System Hub

Other vulnerabilities

The Bank of Canada looks broadly at the financial system to identify, monitor and assess other vulnerabilities. This includes talking to market participants, gathering data and conducting analysis. Vulnerabilities identified in previous issues of the FSR continue to be a focus of attention, including reliance of Canadian banks on foreign funding and the possible effects of exchange-traded funds on the resilience of market liquidity.

Previous issues of the FSR have discussed the funding profile of small and medium-sized banks, focusing on a high reliance on funding from brokered deposits—bank deposits placed by third parties. This type of deposit does not benefit from a strong relationship with the depositor and therefore may be more likely to see withdrawals during times of stress. OSFI has recently revised its Liquidity Adequacy Requirements to require larger liquidity buffers for banks that use deposit funding subject to this kind of risk.[34] The new guideline should help control the vulnerability.

The Bank also pays close attention to developments in financial technologies (fintech). Innovative fintech has the potential to improve financial services, increase competition and boost efficiency. But it can also create new vulnerabilities that can be difficult to understand and assess. In this area, the Bank is helping to examine the merits of a framework for open banking, where consumers can allow access to their banking data to take advantage of new financial products and services.[35] The Bank also participates in the FSB's Financial Innovation Network, which is examining potential risks from large technology companies entering the financial services sector and from increased reliance of financial institutions on cloud computing. This work adds to the monitoring of crypto assets discussed above.

Risks and resilience

» Vulnerabilities can amplify and transmit adverse events. This can harm the economy and threaten financial stability. Systemic risk is analyzed along four dimensions:

1. **Growth at risk**: aggregate downside risk to the real economy associated with financial system vulnerabilities
2. **Key risks to financial stability**: the most important downside risk scenarios
3. **Analysis of resilience**: the financial system's ability to absorb and manage specific risk scenarios
4. **Market views**: participants' perceptions of financial system risks and resilience

- Overall risk to the financial system remains significant and is slightly higher than at the time of the June 2018 FSR.
- A stress test shows the resilience of large Canadian banks. At the same time, bond mutual funds are taking on more risk in a low interest rate environment. Respondents to the Bank's Financial System Survey continue to see the Canadian financial system as highly resilient.

Growth at risk

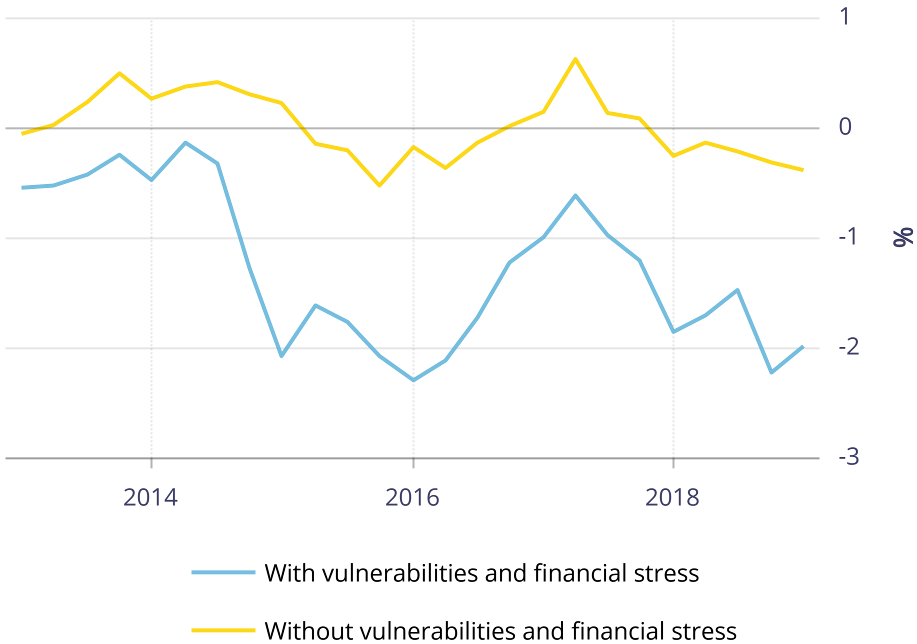
- The growth-at-risk framework quantifies aggregate macrofinancial risks in terms of future economic growth.
- Downside risks to the economy associated with financial vulnerabilities remain significant.

Growth at risk quantifies downside risks to the economy by estimating the rate of future GDP growth that should be exceeded in all but the worst 5 per cent of outcomes.[36, 37] It does not depend on any specific risk scenario but accounts for the effects of financial vulnerabilities and financial market stress on GDP growth outcomes. Because it relies on statistical analysis of aggregate cross-country indicators, growth at risk does not fully capture the evolution of vulnerabilities as analyzed in the sections above. For example, due to limitations in the data, it does not include measures of the quality of debt.

Growth at risk has increased since the June 2018 FSR, mostly because the pace of economic growth has slowed (Chart 16).[38] Financial vulnerabilities and financial market stress magnify the downside risk.

Chart 16: Financial vulnerabilities and stress magnify growth at risk

One-year-ahead forecasts of the 5th percentile of GDP growth



Source: Bank of Canada calculations

Last observation: 2019Q1

Key risks to financial stability

- Beyond the broad assessment of risks measured in growth at risk, Governing Council evaluates the most important downside risk scenarios for the Canadian financial system (Table 2).
- The key risks remain the same as in the June 2018 FSR. Risks have risen slightly over the past year because economic activity in Canada and abroad has slowed and because risk taking has expanded in global financial markets. This expanded risk taking involves some Canadian firms that are relying more on potentially fragile funding sources. The most important risk remains a severe nationwide recession leading to a rise in financial stress.

Table 2: Key risks to the stability of the Canadian financial system

Risk scenarios	Ratings and developments since the June 2018 *Financial System Review*
Risk 1: A severe nationwide recession leading to a rise in financial stress	**Elevated and increasing**
• A large, persistent and negative foreign demand shock affects Canada. Possibilities include a sharp rise in global protectionism (and a disruption in trade and global supply chains) or a severe recession in China and other emerging-market economies. • A foreign demand shock could lead to a severe recession in Canada, with a sharp rise in unemployment nationwide, a correction in house prices and tighter global financial conditions. • Household and housing market vulnerabilities interact to create stress on lenders and the broader Canadian financial system.	• Uncertainty and tensions around global trade arrangements and Brexit have increased over the past year. • Canadian economic growth has slowed, leading to slower growth in incomes. • Credit growth remains soft, and riskier mortgage originations have declined to lower levels. However, a large amount of debt in Canada continues to be held by highly indebted households. • Households are adjusting to higher interest rates with limited signs of stress.
Risk 2: A house price correction in overheated markets	Moderate and decreasing
• Significant house price corrections occur in Toronto, Vancouver and their surrounding areas, with modest direct spillovers to other housing markets. • Residential investment and related consumption fall dramatically in affected regions. • Lender balance sheets deteriorate, and credit conditions tighten.	• Froth has declined in the Toronto and Vancouver area housing markets. While the Toronto market appears to be stabilizing, in Vancouver, declines in prices and activity continue. Prices in the Vancouver area are down 5 per cent for the year ending in March 2019. • Prices remain 40 to 60 per cent higher than at the beginning of 2015, when they began to accelerate. But strong fundamentals support these markets. • Ongoing adjustments in the oil sector are weighing on housing markets in the oil-producing provinces. Prices are down 10 per cent from their peak in 2015. • A quantitative assessment of this risk shows a moderate impact on the banking sector.[39]
Risk 3: A sharp increase in long-term interest rates driven by higher global risk premiums	Moderate and increasing

Table 2: Key risks to the stability of the Canadian financial system

Risk scenarios	Ratings and developments since the June 2018 *Financial System Review*
• A severe disruption in financial markets is triggered by a sharp repricing of credit risk. • Higher global risk premiums could be caused by an overreaction to economic or policy developments, such as an unexpected increase in inflation prospects, escalation in trade tensions or the materialization of geopolitical risks such as a hard Brexit. • Financial contagion affects a wide range of asset classes with adverse effects on the real economy. • The resulting collapse in valuations puts many financial institutions under stress. This is amplified by past risk taking in the non-bank financial sector.	• Geopolitical risks and trade tensions are higher. • Risk taking is elevated, risk premiums are low, and debt levels are higher than a year ago, suggesting markets are in the late stage of the credit cycle. • Strong investor demand and deterioration in the creditworthiness of Canadian firms in certain sectors have led to increased reliance on US high-yield bonds and leveraged loans for funding. • A sudden increase in risk premiums in riskier debt markets in December underlines the vulnerability of corporate borrowers to shifts in market sentiment.

Risk ratings:	Low	Moderate	Elevated	High	Very high

Analysis of financial system resilience

- Stress tests can help gauge the possible impact of risk scenarios and the ability of the Canadian financial system to absorb and manage risks.
- A first stress test investigates the impact from an extreme but plausible scenario based on the key risks. In this scenario, the banking system experiences substantial losses, but regulatory capital buffers absorb these losses and help maintain resilience.
- A second stress test looks at how a sharp rise in interest rates affects mutual funds that specialize in corporate bonds. It shows that, with their increasing size and riskier portfolio holdings, these funds would have larger effects on market liquidity than in the past.

A macrofinancial stress test of large banks

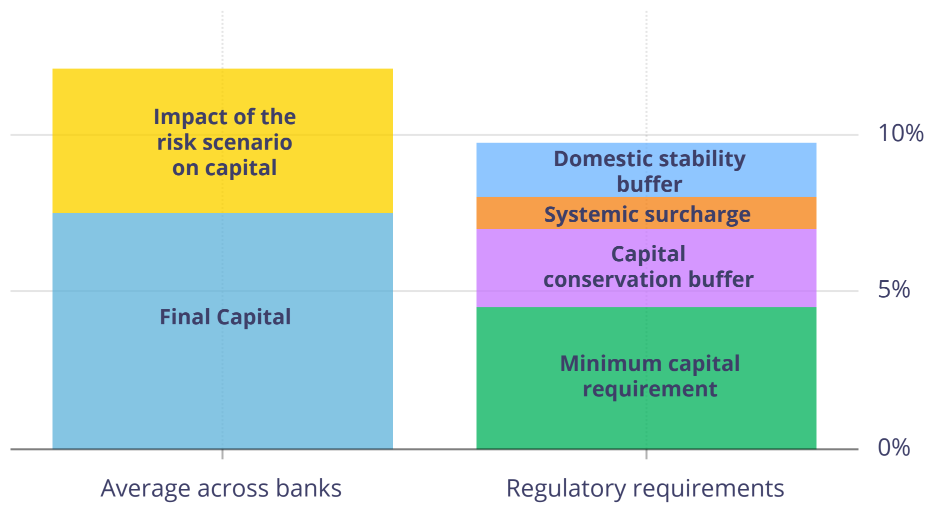
Quantitative analysis of a severe but plausible risk scenario helps assess the resilience of the banking system. The Bank developed the macroeconomic risk scenario in collaboration with the International Monetary Fund.[40] Bank staff assessed the scenario's impact on the banking system.

The risk scenario is a composite of the key risks identified above. It is assumed to be triggered by disruptions in international trade, which would tighten financial conditions, increasing risk premiums worldwide. Inflation would rise in Canada due to disruptions in global supply chains and a large depreciation of the Canadian dollar. Interest rates are assumed to rise initially to stabilize inflation expectations and then fall to address the economic contraction. The effects would be severe enough to also trigger a major recession and a house price correction. The unemployment rate would increase by 6 percentage points, and national house prices would drop by 40 per cent. The severity of this scenario is calibrated based on international experience with financial crises and is much worse than any economic shock in Canada in recent decades.

Large banks would suffer substantial losses in this risk scenario but would remain resilient.[41] The largest losses would come from consumer debt, notably credit cards, and from business loans, both domestic and international. Capital levels would fall materially, driven by these losses as well as by reduced revenues (Chart 17). The scenario would not, however, be severe enough to bring capital below the regulatory minimum or to trigger substantial fire sales, funding liquidity stress or interbank contagion effects.

Chart 17: Regulatory capital buffers help make the banking system resilient

Common equity Tier 1 capital as a percentage of risk-weighted assets



Note: Desjardins Group operates under capital requirements set by the Autorité des marchés financiers, which are somewhat different than the requirements shown here.
Source: Bank of Canada calculations

Banks would weather this storm in part because initial capital levels include substantial buffers to handle losses. These buffers include

- a capital conservation buffer of 2.5 per cent and a surcharge of 1 per cent applied to domestic systemically important banks;
- the new domestic stability buffer, which was introduced in June 2018 and is currently set at 1.75 per cent; and
- additional capital beyond the regulatory requirements held at the discretion of each bank.

OSFI sets the level of the domestic stability buffer twice per year based on monitoring of a range of systemic vulnerabilities done in consultation with the Bank of Canada and other federal authorities.

These buffers are designed to help banks manage the materialization of risks, while minimizing the effects on the financial system. They allow banks the space to take corrective action before their viability is threatened.

The Canadian mortgage insurance system also limits the impact on banks. This system protects banks against losses on some of their riskiest mortgages—those with a high loan-to-value ratio. The losses on insured mortgages instead fall on mortgage insurers. Mortgage insurance is guaranteed by the federal government—fully for CMHC and subject to a 10 per cent deductible for private mortgage insurers.

Significant uncertainties around the results remain. For example, the assumptions of losses on loan portfolios are conservative and may overestimate actual losses. In contrast, extreme economic uncertainty might cause a rise in risk aversion and a loss of confidence in the banks that is greater than that incorporated in the analysis. If that were to occur, bank creditors would withdraw more funding.

There is also uncertainty about how banks would respond. Banks may aggressively cut costs to protect earnings. They may also decide to deleverage more than the scenario assumes. That could protect bank capital but also result in a further tightening of financial conditions, which would exacerbate the negative effects on the economy. In addition, this analysis does not incorporate the effects of interventions by authorities, who have tools they can deploy to support the functioning of the financial system.

Read more about the resilience of the banking system on the Financial System Hub

While the core of the financial system has become more resilient, risks may move elsewhere in the system. The Bank monitors these developments, with a specific focus on non-bank entities engaged in financial intermediation activities that involve a significant amount of maturity, liquidity and credit transformation.

Read “Non-Bank Financial Intermediation in Canada” on the Financial System Hub

A stress test of corporate bond funds

Over the past decade, open-ended fixed-income mutual funds with large holdings of corporate bonds (bond funds) have grown significantly. These bond funds offer daily redemptions to investors, but they hold assets that may be difficult to sell on short notice. If many investors were to withdraw simultaneously, the funds might be forced to quickly sell bonds to honour their commitments, potentially decreasing liquidity in the bond market. A decrease in liquidity could have negative consequences for both bondholders and bond issuers, which could amplify the effect of an adverse shock on the financial system. Asset managers are, however, aware that market liquidity may be less reliable than in the past and have indicated that they are altering their portfolio management strategies to prepare for periods of low liquidity.[42] This should mitigate the impacts of a decline in liquidity on the financial system.

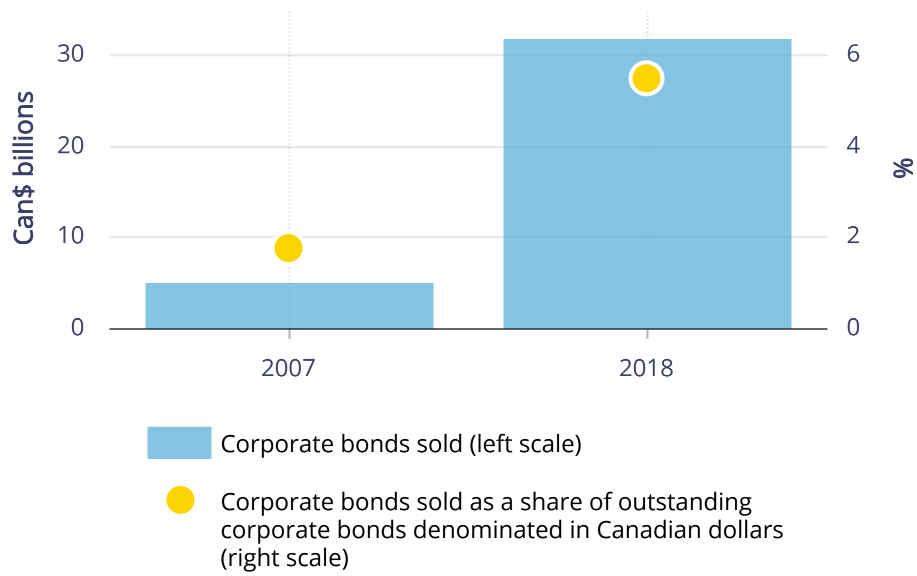
Bank staff analyzed a scenario where both short- and long-term interest rates increase sharply, by 100 basis points over one quarter, using data from the end of 2018. This scenario could be caused by sudden changes in economic or financial conditions outside of Canada, such as in Risk 3. Similar interest rate increases in Canada in the 1980s and 1990s led to increases in market stress.

Bond funds would suffer losses on their investments and face large investor redemptions in this risk scenario. When interest rates increase, the value of bond investments decreases. Based on historical relationships between fund performance and investor demand for redemptions at the fund level, bond funds would experience redemptions estimated at around $70 billion out of a total of around $350 billion in assets under management. How individual bond fund managers would react depends on their investment strategy and risk management practices, which are quite varied. For example, passively managed funds would behave differently than actively managed funds.

In this analysis, bond fund managers are assumed to behave identically and sell assets proportionally to their holdings. Bond funds are estimated to collectively sell more than $30 billion in corporate bonds (Chart 18). The impact on bond prices depends on the willingness of bond buyers such as broker-dealers and long-term investors (including pension funds and insurance companies) to buy from the bond funds.

The sale of corporate bonds by funds would have a larger impact on fixed-income market liquidity than in the past. The liquidity risk premium would increase by an estimated 93 basis points compared with around 40 basis points if it had happened in 2007 (Chart 19). This is because of both demand and supply factors. On the demand side, mutual funds have grown; they hold more corporate bonds, including more bonds with lower credit quality, and they have reduced their cash buffers. On the supply side, post-crisis regulations have increased the cost for broker-dealers to intermediate large and relatively sudden investor flows.[43]

Chart 18: A 100-basis-point increase in interest rates would lead to much larger sales of corporate bonds today than a decade ago…

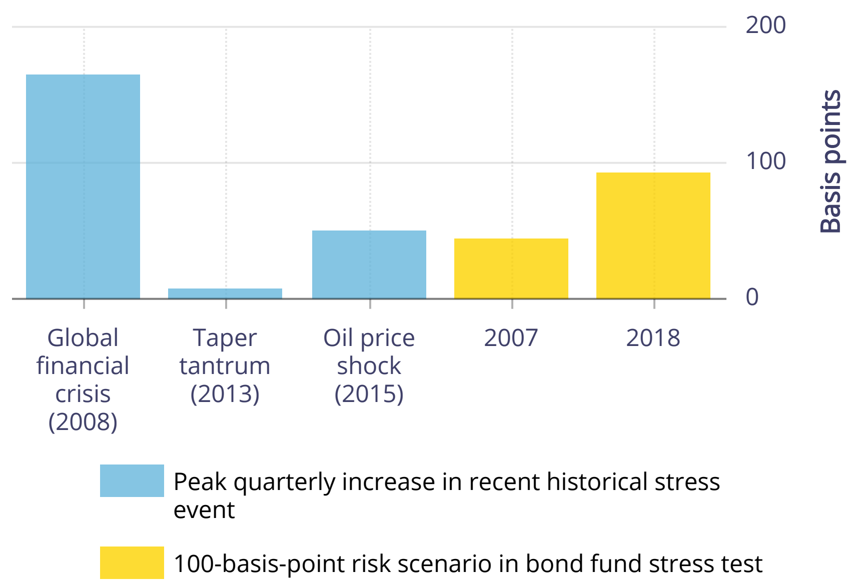


Sources: Morningstar Direct, Statistics Canada and Bank of Canada calculations

Last observation: 2018

Chart 19: … resulting in a more pronounced impact on corporate bond price

Liquidity risk premium



Note: The liquidity risk premium is the compensation for risk beyond expected default.

Sources: Bloomberg Finance L.P., Morningstar Direct and Bank of Canada calculations

Last observation: 2018

The results depend on several assumptions and are subject to significant uncertainty. For instance, if bond funds were to rely primarily on their holdings of cash and liquid assets to meet redemption demands, the increase in the liquidity risk premium would be lower initially—although the funds would then be less able to deal with future redemptions. In contrast, the increase in the liquidity risk premium would be larger if long-term investors are assumed not to purchase corporate bonds from mutual funds. This illustrates that the countercyclical behaviour of long-term investors can be an important stabilizing force. In addition, as previously mentioned, asset managers are altering their portfolio management strategies to prepare for periods of low liquidity, which should mitigate the impacts on the financial system of a scenario like the one examined here.

Read more on the Financial System Hub in “Could Canadian Bond Funds Add Stress to the Financial System?”

Market views of risk and resilience

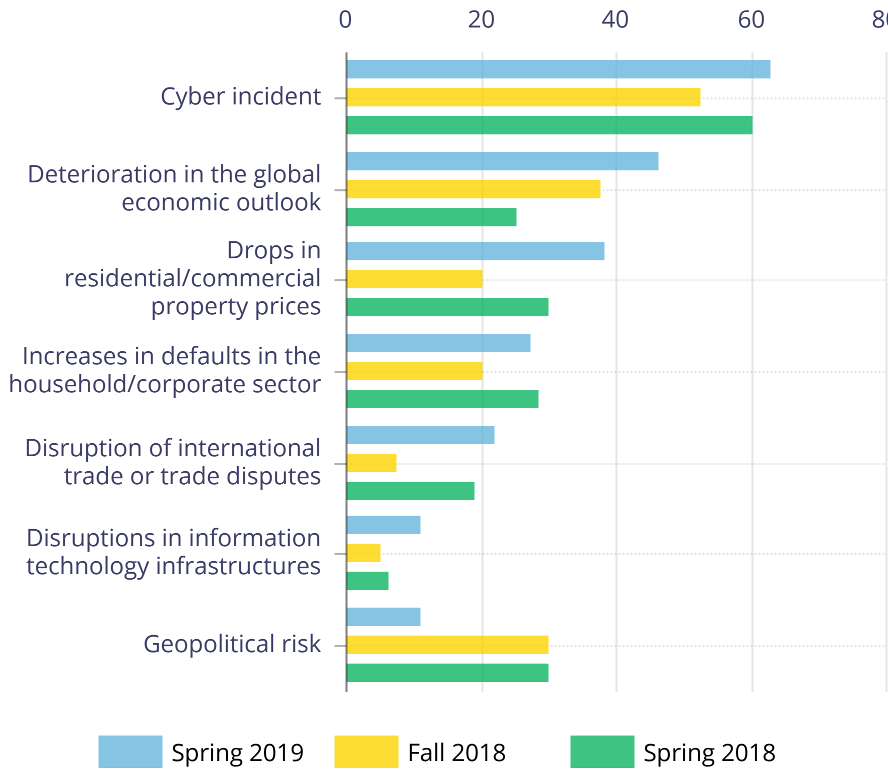
- The views of market participants are helpful in identifying financial system risks and assessing the resilience of the system to those risks.
- In the Bank of Canada’s semi-annual Financial System Survey, respondents view risks as continuing to rise, but their confidence in the system’s resilience remains high. Indicators based on market values of bank equity also show high confidence.

The Bank solicits the views of financial system participants through its Financial System Survey. The survey results are a useful point of comparison for the Bank’s views and analytical work. The survey also provides information in areas where the Bank has limited data or experience and helps identify new topics for analysis.

The overall perception of risk has continued to edge higher, but confidence in the resilience of Canada’s financial system remains high. Once again, respondents from the Canadian financial system identified a cyber incident as the greatest risk. The perceived risk from a deterioration in the global economic outlook or a drop in residential and commercial property prices increased (Chart 20).

Chart 20: A deterioration in the global economic outlook is increasingly cited as an important risk to the Canadian financial system

Percentage of respondents who cited a given risk in their top three



Notes:
1. Financial System Survey question: “Over the next three years, which risks, if realized, do you believe would have the greatest negative impact on the functioning of the Canadian financial system (i.e., can impair the financial system and harm the economy)?”
2. As part of the question, respondents are asked to list their top three risks. The responses are grouped into different types of risks.
Source: Bank of Canada Financial System Survey

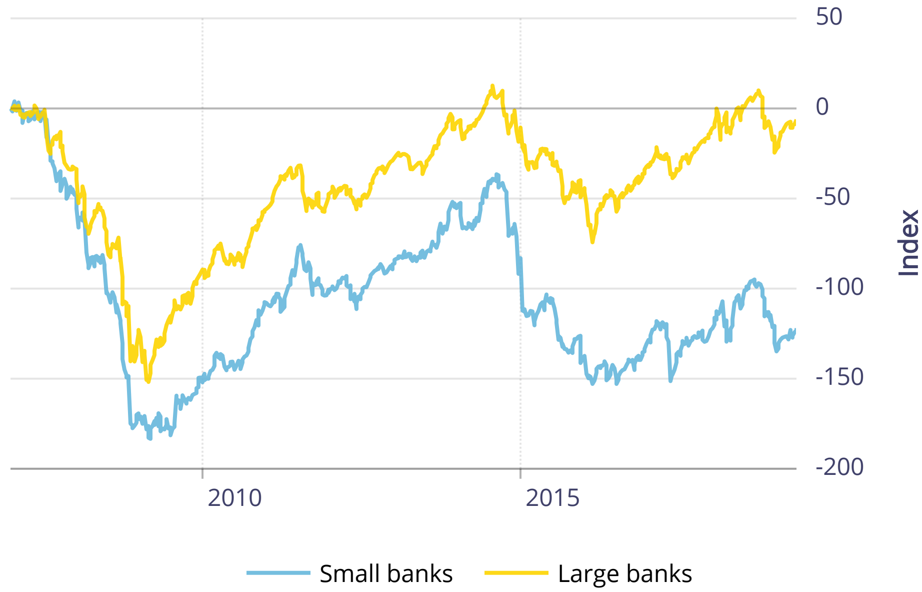
Last observation: Spring 2019

Read more about the Financial System Survey on the Financial System Hub

Market perceptions of banking system resilience can also be inferred from the information contained in market data, including stock prices. A composite index of market-based indicators suggests the perceived resilience of large banks is close to its highest level since the crisis (Chart 21). Small banks are considered less resilient than they were.[44]

Chart 21: Market perceptions of the resilience of large banks are in line with pre-crisis levels

Index of resilience (2007 = 0)



Note: See C. MacDonald and M. R. C. van Oordt, "Using Market-Based Indicators to Assess Banking System Resilience," Bank of Canada *Financial System Review* (June 2017): 29–41.
Sources: Datastream and Bank of Canada calculations

Last observation: April 2019

Safeguarding the financial system

» The Bank of Canada works with other authorities in Canada and internationally to foster a stable and efficient financial system. This includes measures to increase the resilience of financial institutions and financial market infrastructures and measures to keep core funding markets working, even through periods of stress. Policy measures related to the vulnerabilities analyzed above are discussed in those sections. In addition, other notable policy developments contribute to a stable and efficient financial system.

Proposed enhancements should strengthen Canada's interest rate benchmarks. Interest rate benchmarks are used globally to set payments for trillions of dollars of financial contracts, such as variable-rate loans and derivatives. Questions regarding the integrity of some of these rates, especially the London Interbank Offered Rate (LIBOR), have threatened confidence in some financial benchmarks. The resulting uncertainty represents a potentially serious source of systemic risk. Regulators from many countries are therefore reviewing benchmarks to improve their robustness and reliability.

The Canadian Fixed-Income Forum formed the Canadian Alternative Reference Rate Working Group (CARR) to review and improve existing Canadian benchmark rates and assess whether new rates should be developed. Deputy Governor Lynn Patterson discussed this in her speech "Rebooting Reference Rates." Since then, the focus has been on two benchmarks:

- The Canadian Overnight Repo Rate Average (CORRA) is a transaction-based benchmark that measures the cost of overnight repurchase agreement (repo) funding. CORRA is primarily used in the derivatives market for setting payments on overnight indexed swaps. It is currently based on the relatively small number of general collateral repo transactions conducted through interdealer brokers. To make CORRA more robust and representative of the entire market, CARR has proposed broadening the range of transactions considered and modifying the calculation methodology.
- The Canadian Dollar Offered Rate (CDOR) is the primary benchmark rate for financial products denominated in Canadian dollars. It is a term rate that represents the cost for borrowers to draw from their bankers' acceptance facilities.[45] Because CDOR is survey-based, there is a risk that it could be discontinued if respondents stopped providing quotes for its calculation. To guard against this risk, CARR is developing more robust fallback language for certain types of financial contracts referring to CDOR. This would set out which alternative rates could be used for determining payments if CDOR was discontinued permanently. CARR is also investigating the need for a new term risk-free rate to complement CDOR and act as a credible fallback.

Resilience and continuity of the Bank of Canada's market and banking operations will strengthen financial stability. These operations are essential for implementing the Bank's core functions in monetary policy, funds management and the financial system. In early 2019, the Bank officially opened its first parallel operating site in Calgary for its market and banking operations. The Calgary Operational Site will work with Head Office and share day-to-day operational responsibilities. Once fully functional, this site will maintain the Bank's critical market and banking operations in the event of any disruptions in the National Capital Region.

The Bank of Canada has reduced mechanistic reliance on ratings from credit rating agencies. Such reliance can cause rating downgrades to have drastic effects on issuers and asset holders, potentially causing systemic disruptions. For this reason, the Bank of Canada has been implementing, in its own policies, the FSB's principles for reducing reliance on ratings from credit rating agencies. In July 2018, the Bank removed the mechanistic reliance on credit rating agencies from its collateral policy related to the Standing Liquidity Facility.[46]

Progress on modernizing Canada's payment systems continues. Payments Canada continues to make progress toward creating three new payment platforms: a new high-value payment system called Lynx, an enhanced retail system for clearing paper-based and electronic batch payments, and a real-time payment system.[47] An application provider and a vendor to provide hosting and system integration for Lynx have been selected. Design work continues on the retail batch and real-time payment systems. In addition, the Government of Canada proposed in Budget 2019 to require payment service providers to establish sound operational risk management practices and to protect users' funds against losses. The Bank of Canada would oversee compliance with these requirements, which were outlined in the government's consultation paper on the retail payments oversight framework.

Notes

The *Financial System Review* is a product of the Governing Council of the Bank of Canada: Stephen S. Poloz, Carolyn A. Wilkins, Timothy Lane, Lawrence Schembri, Lynn Patterson and Paul Beaudry.

This report includes data received up to May 9, 2019.

1. C. A. Wilkins, "The Age of Leverage" (remarks at the UBC Vancouver School of Economics and CFA Society Vancouver, March 14, 2019), and International Monetary Fund, *Global Financial Stability Report*, April 2019. [←]
2. Previously published data showed strong growth in home equity lines of credit (HELOCs). But isolating HELOCs in data on real-estate-based lending is challenging because they are often offered as part of combined mortgage-HELOC plans. New reporting allows a better breakdown of the different types of real-estate-based lending, as discussed in L. Al-Mqbali, O. Bilyk, S. Caputo and J. Younker, "Reassessing the Growth of HELOCs in Canada Using New Regulatory Data," Bank of Canada Staff Analytical Note No. 2019-14 (May 2019). [←]
3. Mortgage insurance rules and mortgage underwriting guidelines have been tightened several times in recent years. See "Appendix: Mortgage Finance Policy Changes in Canada," Bank of Canada *Financial System Review*, June 2017; Office of the Superintendent of Financial Institutions, "OSFI Is Reinforcing a Strong and Prudent Regulatory Regime for Residential Mortgage Underwriting," Press Release, October 17, 2017; and "Box 1: Mortgage Interest Rate Stress Tests," Bank of Canada *Financial System Review*, June 2018. [←]
4. CMHC, as guarantor, is exposed to risks from *National Housing Act* Mortgage-Backed Securities approved issuers, including credit unions. It mitigates some of these risks by establishing broad requirements for approved issuers, including requirements to provide data on their entire mortgage portfolio. [←]
5. These statements pertain strictly to fixed-rate mortgages with a term of five years or longer that are used to buy homes that will be occupied by the purchaser. This is the key segment of the market affected by changes to mortgage stress-testing practices that took effect in 2018. [←]
6. Read more about mortgage investment corporations on the Financial System Hub in G. Bédard-Pagé, "Non-Bank Financial Intermediation in Canada: An Update." March 26, 2019 [←]

7. This new measure is much broader than measures of mortgage arrears rates, which remain very low at around 0.25 per cent nationally. [←]
8. The indicators reported in this box are based on the 1999 and 2016 Survey of Financial Security (SFS) and use total income before taxes and deductions for debt-to-income calculations. Previous issues of the FSR relied on the Canadian Financial Monitor and used self-reported total household income. [←]
9. The threshold of the 350 per cent debt-to-income ratio matches the threshold estimated in G. Cateau, T. Roberts and J. Zhou, "Indebted Households and Potential Vulnerabilities for the Canadian Financial System: A Microdata Analysis," Bank of Canada *Financial System Review*, December 2015: 49–58. [←]
10. S. S. Poloz, "Risk Sharing, Flexibility and the Future of Mortgages," (remarks at the Canadian Credit Union Association and Winnipeg Chamber of Commerce, Winnipeg, May 6, 2019). [←]
11. See "Budget 2019: An Affordable Place to Call Home." [←]
12. CMHC estimates that the impact on house prices of the First-Time Home Buyer Incentive will be negligible. See CMHC, "Making Housing More Affordable: Canada's First-Time Home Buyer Incentive," April 2019. [←]
13. See previous issues of the *Financial System Review*, including "Box 4: Extrapolative Expectations May Be Driving Investment Activity," Bank of Canada *Financial System Review*, June 2017. [←]
14. M. Khan and T. Webley, "Disentangling the Factors Driving Housing Resales," Bank of Canada Staff Analytical Note No. 2019-12; and T. Webley, "Fundamental Drivers of Existing Home Sales in Canada," Bank of Canada Staff Discussion Paper No. 2018-16. [←]
15. M. Khan and M. Verstraete, "Non-Resident Taxes and the Role of House Price Expectations," Bank of Canada Staff Analytical Note No. 2019-8. [←]
16. G-7, "G-7 Fundamental Elements for Third Party Cyber Risk Management in the Financial Sector." [←]
17. Over the period of the survey, incidents were reported to the federal government through the Canadian Cyber Incident Response Centre. This function has now been taken over by the Canadian Centre for Cyber Security. [←]
18. Based on the Compustat database, which covers 1999 to 2018. Income is measured as earnings before interest, taxes, depreciation and amortization (EBITDA). [←]
19. T. Grieder and C. Schaffter, "Measuring Non-Financial Corporate Sector Vulnerabilities in Canada," Bank of Canada Staff Analytical Note No. 2019-15. [←]
20. The total non-financial corporate debt as a share of GDP is similar for both Canada (75 per cent) and the United States (73 per cent). See International Monetary Fund, *Global Financial Stability Report*, April 2019, and Federal Reserve Board, *Financial Stability Report*, May 2019. See also C. A. Wilkins, "The Age of Leverage" (remarks at the UBC Vancouver School of Economics and CFA Society Vancouver, March 14, 2019). [←]
21. Non-bank credit excludes lending by deposit-taking financial institutions. The share of bonds in total non-financial corporate debt in Canada has been relatively stable over the past decade, at around 40 per cent. But, since leveraged loans are almost all sold to investors they can also be considered part of non-bank credit. This would effectively increase the share non-bank credit by about 10 percentage points. [←]
22. S. Çelik, G. Demirtaş and M. Isaksson, "Corporate Bond Markets in a Time of Unconventional Monetary Policy," OECD Capital Market Series (February 2019). [←]
23. International Monetary Fund, *Global Financial Stability Report*, April 2019. [←]
24. Refinitiv DataScope fixed-income data and Bank of Canada calculations. [←]
25. The bond data from Refinitiv and credit rating data from Moody's do not cover the entire market, and the extent of the coverage of the leveraged loan market from Bloomberg is

uncertain. The actual share of the funding from leveraged loan and high-yield bond markets combined is therefore likely to be larger than the estimate of 12 per cent. [←]

26. Insurance Bureau of Canada, "2018 Facts of the Property and Casualty Insurance Industry in Canada." [←]
27. See *Canada's Changing Climate Report*. [←]
28. T. Lane, "Decrypting 'Crypto'" (remarks at the Haskayne School of Business, University of Calgary, October 19, 2018). [←]
29. Financial Action Task Force, "Regulation of Virtual Assets," October, 19, 2018. [←]
30. Basel Committee on Banking Supervision, "Statement on Crypto-Assets," March 13, 2019. [←]
31. Canadian Securities Administrators, *Proposed Framework for Crypto-Asset Trading Platforms*, Joint Canadian Securities Administrators/Investment Industry Regulatory Organization of Canada Consultation Paper 21-402, March 14, 2019. [←]
32. Financial Stability Board, "Crypto-Assets: Report to the G20 on the Work of the FSB and Standard-Setting Bodies," July 16, 2018. [←]
33. The Heads of Regulatory Agencies is chaired by the Governor of the Bank of Canada and includes the Department of Finance Canada, OSFI, the Quebec Autorité des marchés financiers, the Ontario Securities Commission, the Alberta Securities Commission and the British Columbia Securities Commission. [←]
34. OSFI, "OSFI Promotes Financial Institution Resilience with Revisions to Its Liquidity Adequacy Requirements Guideline," News Release, April 11, 2019. [←]
35. Department of Finance Canada, "A Review into the Merits of Open Banking," Consultation Document, January 2019. [←]
36. Growth at risk is measured as the fifth percentile of year-over-year growth, one year ahead. [←]
37. See T. Adrian, N. Boyarchenko and D. Giannone, "Vulnerable Growth," *American Economic Review* 109, no. 4 (April 2019): 1263–1289; and T. Duprey and A. Ueberfeldt, "How to Manage Macroeconomic and Financial Stability Risks: A New Framework," Bank of Canada Staff Analytical Note No. 2018-11. [←]
38. The growth figures refer to year-over-year percentage change, which differs from the quarter-over-quarter annualized measure of GDP growth underlying growth at risk in Chart 2-B of the June 2018 FSR. [←]
39. T. Duprey, X. Liu, C. MacDonald, M. van Oordt, S. Priazhkina, X. Shen, J. Slive and V. Traclet, "Financial System Resilience and House Price Corrections," Bank of Canada Financial System Hub (November 14, 2018). [←]
40. The International Monetary Fund conducted its work as part of its 2019 assessment of Canada under the Financial Sector Assessment Program and will publish its own analysis later this year. [←]
41. The analysis includes the six banks designated as domestic systemically important banks by the Office of the Superintendent of Financial institutions (Bank of Montreal, Bank of Nova Scotia, Canadian Imperial Bank of Commerce, National Bank of Canada, Royal Bank of Canada and Toronto-Dominion Bank) and Desjardins Group, which is designated as a domestic systemically important financial institution by the Autorité des marchés financiers in Quebec. [←]
42. Canadian Fixed-Income Forum, "CFIF Survey Results on Liquidity, Transparency and Market Access in Canadian Fixed Income Markets," October 2016. [←]
43. D. Cimon and C. Garriott, "Banking Regulation and Market Making," Bank of Canada Staff Working Paper No. 2017-7. [←]
44. The indicators are described in C. MacDonald and M. R. C. van Oordt, "Using Market-Based Indicators to Assess Banking System Resilience," Bank of Canada *Financial System*

Review (June 2017): 29–41. [←]

45. K. McRae and D. Auger, "A Primer on the Canadian Bankers' Acceptance Market," Bank of Canada Staff Discussion Paper No. 2018-6 (June 2018). [←]
46. "Changes to Assets Eligible as Collateral under the Bank of Canada's Standing Liquidity Facility," Bank of Canada Market Notice, July 23, 2018. [←]
47. Payments Canada, "Modernization," 2019. [←]