BANK OF CANADA
BANQUE DU CANADA

Financial System Review

November 2017

Canada's Financial System

The Financial System and the Economy

- A stable and efficient financial system is essential for sustained economic growth and rising living standards.
- The ability of households and firms to channel savings into productive investments and manage the associated risks with confidence is one of the fundamental building blocks of our economy.

Systemic Risk

- Financial system vulnerabilities are pre-existing conditions that can amplify or propagate shocks. Examples include high leverage and asset price misalignments, as well as maturity and funding mismatches. The interaction between vulnerabilities and triggers can lead to the realization of risks that can impair the financial system and harm the economy.
- Actions to reduce vulnerabilities and increase the resilience of the financial system help reduce systemic risk and support financial stability.

The Role of the Bank of Canada

- As part of its commitment to promote the economic and financial welfare of Canada, the Bank of Canada actively fosters a stable and efficient financial system.
- The Bank does this by providing central banking services, including various liquidity and lender-of-last-resort facilities, overseeing key Canadian financial market infrastructures, conducting and publishing analyses and research, and helping to develop and implement policy.
- The Bank collaborates with international, federal and provincial authorities to achieve its financial system goals.

The Financial System Review

- In the *Financial System Review* (FSR), the Bank analyzes the resilience of the Canadian financial system. The first section of the FSR summarizes the judgment of the Bank of Canada's Governing Council on the main vulnerabilities and risks to financial stability. It also highlights the efforts of authorities to mitigate those risks.
- Financial and macroeconomic stability are interrelated. The FSR's assessment of financial risks is therefore presented in the context of the Bank's assessment of macroeconomic conditions, as given in its *Monetary Policy Report*.
- The FSR also presents staff analysis of the financial system and policies to support its resilience. More generally, the FSR promotes informed discussion on all aspects of the financial system. The *Financial System Review* is available on the Bank of Canada's website at bankofcanada.ca.

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ISSN 1705-1290 (Print)
ISSN 1705-1304 (Online)

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This report includes data received up to November 21, 2017.

Contents

Assessment of Vulnerabilities and Risks

Overall risks to the Canadian financial system remain elevated. Some preliminary signs of improvement, however, are emerging. Better economic conditions and several new policy measures support prospects for additional progress.

The global economic expansion has strengthened and broadened across countries. In Canada, the economic expansion is supporting an improving labour market, especially employment growth.

The most important vulnerability to the financial system remains the elevated level of household indebtedness, especially the large share of debt held by highly indebted households. The effects of tighter mortgage rules implemented last year have already improved the quality of new insured lending. Income growth, new mortgage finance policy measures and higher mortgage rates are expected to mitigate this vulnerability over time. The latter two are also expected to weigh on housing activity, especially in regions with housing market imbalances.

The interconnected financial system remains vulnerable to cyber threats. To lessen the systemic impact of a cyber attack on key financial system participants, the Bank is working closely with industry and public sector partners to reinforce the resilience of the wholesale payments system. This system is crucial to the smooth functioning of the Canadian financial system.

Macrofinancial Conditions

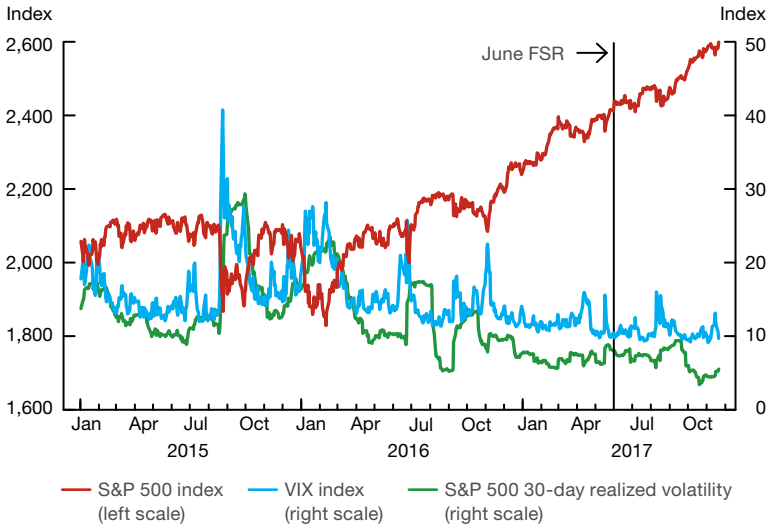
Global financial conditions remain accommodative

Long-term sovereign yields remain low, in part because of low global policy rates as well as ongoing asset purchases by some major central banks. The US Federal Reserve has taken a first step to normalize its balance sheet by decreasing the amount of reinvestment of principal payments upon maturity.[1] There has been little market reaction to date, and term premiums have remained within recent ranges.

Energy and other commodity prices have firmed in response to sustained demand and rising geopolitical concerns. Risk assets continue to be characterized by high valuations, favourable corporate lending spreads and low volatility (**Chart 1**).

1 See Federal Reserve, "Federal Reserve Issues FOMC Statement," September 20, 2017.

Chart 1: Volatility remains low as equity prices continue to rise



Note: The VIX is a volatility index derived from options on the S&P 500 index.
Source: Bloomberg Finance L.P. Last observation: November 21, 2017

Financial conditions in Canada have become less stimulative

Financial conditions are less stimulative after the increase in policy rates in June and September. Bond yields have risen across all maturities and are reflected in higher borrowing rates for businesses and households. Five-year fixed mortgage rates are 70 basis points higher than they were in June and are at roughly the same level as five years ago. Variable mortgage rates increased by about 50 basis points in the same time frame.[2]

Key Vulnerabilities in the Canadian Financial System

Vulnerability 1: Elevated Level of Canadian Household Indebtedness

Household indebtedness continues to be the most important vulnerability for the financial system, especially given the large share of debt held by highly indebted households. Policy changes to housing finance, higher interest rates and growth in household income should continue to mitigate this vulnerability over time. The pace and degree of these developments are, however, uncertain.

Mortgage underwriting requirements are being tightened

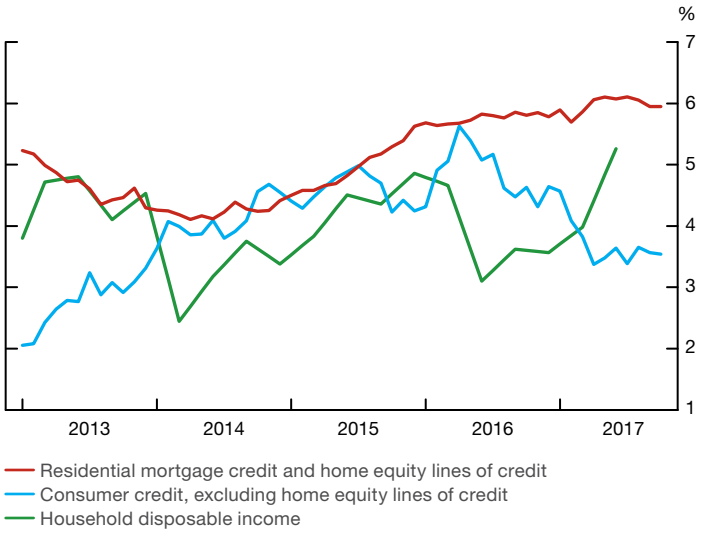
The mortgage market can be divided into two segments: high-ratio mortgages with loan-to-value ratios greater than 80 per cent and low-ratio mortgages with loan-to-value ratios of 80 per cent or less.[3] All high-ratio mortgages are required to have insurance against default risk, backed by government guarantees.

2 This is a Bank of Canada calculation based on mortgage rate data from LenderSpotlight, which reports rates offered by lenders in the broker channel. The variable rate is for five-year mortgages.

3 Further discussion of the differences between high- and low-ratio mortgages is provided in Table 1 of the report "Analysis of Household Vulnerabilities Using Loan-Level Mortgage Data" in this issue and in Box 2 of the June 2017 Bank of Canada *Financial System Review.*

Chart 2: Household credit growth is mostly from mortgage lending

Year-over-year growth



Sources: Statistics Canada and Bank of Canada calculations

Last observations: Credit series, October 2017; disposable income, 2017Q2

In autumn 2016, the federal government introduced changes to mortgage insurance policy to tighten the qualifying rules for high-ratio mortgages. The changes put in place a stress test for all insured mortgages that evaluates whether borrowers can still afford their mortgage payments if interest rates rise.[4] In October 2017, the Office of the Superintendent of Financial Institutions (OSFI) further refined the guidelines for low-ratio mortgages when it updated Guideline B-20—*Residential Mortgage Underwriting Practices and Procedures*. A similar mortgage qualification stress test was included in this update.[5] Both changes limit the creation of new highly indebted households.

Household credit continues to grow faster than income

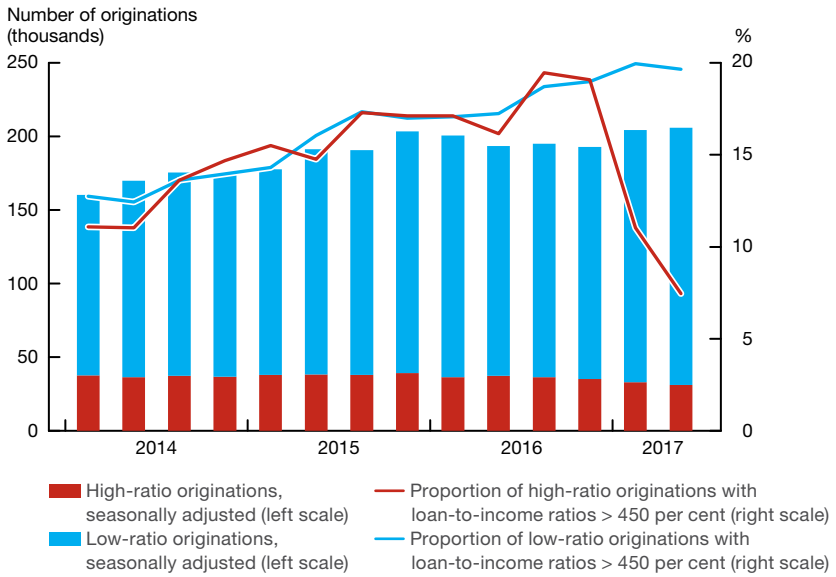
The level of household debt relative to income in Canada remains high by historical standards and continues to rise. This is driven by growth in mortgages and home equity lines of credit (HELOCs) (**Chart 2**), which constitute more than 80 per cent of outstanding household debt.

HELOCs are part of roughly two of every five outstanding loans secured by residential real estate that are on the lending books of federally regulated lenders. Some lenders promote products that combine a HELOC (which can amount to 65 per cent of the home's value) with a traditional mortgage.

4 The stress test was already in place for insured mortgages with variable interest rates or those with fixed interest rates and terms less than five years. The mortgage insurance rules also apply the same underwriting criteria to portfolio-insured and transactional-insured low-ratio mortgages that, until the change, had been applied only to high-ratio mortgages. This prevents mortgages for homes priced over $1 million, mortgages with amortization periods longer than 25 years and mortgage refinances from being insured.

5 The changes to the OSFI Guideline B-20 require that debt-service ratios be tested at the contract rate plus two percentage points or at the Bank of Canada five-year posted rate, whichever is greater. This contrasts with the autumn 2016 changes to mortgage insurance rules, which require the use of the greater of the contract rate or the Bank's five-year posted rate. Lenders have somewhat greater flexibility in applying the OSFI B-20 changes, however, as described later in this section. Before this revision, a stress test had already been in place for mortgages with variable interest rates or those with fixed interest rates and terms less than five years. More information is available on the OSFI website.

Chart 3: Fewer mortgages are going to highly indebted, high-ratio borrowers



Note: Data include purchases and refinances originated by federally regulated financial institutions.
Sources: Department of Finance Canada, regulatory filings of Canadian banks and Bank of Canada calculations
Last observation: 2017Q2

This expanding use of HELOCs provides greater financial flexibility to borrowers. For example, taking advantage of recent run-ups in real estate prices, some homeowners are using HELOCs to extract equity from their homes to pay for renovations, debt consolidation and investments, and for other reasons.[6] HELOCS may also contribute to increased household vulnerabilities. They typically do not require the principal to be repaid on a fixed schedule, and around 40 per cent of HELOC borrowers do not make regular payments that cover both interest and principal.[7] If more equity is extracted and debt is not paid down, aggregate household debt will increase, making the financial system and economy more vulnerable to a rise in unemployment.

The quality of new high-ratio mortgages has improved

As expected, the autumn 2016 stress test for high-ratio insured mortgages reduced the total number of new high-ratio mortgages. By the second quarter of 2017, originations had fallen by 17 per cent relative to a year earlier (**Chart 3**). By a rough estimate, around half of borrowers affected by the stress test were able to reduce their debt-service ratio by enough to qualify for a high-ratio mortgage, in part by purchasing less-expensive homes.

Most notably, the proportion of highly indebted households (with a loan-to-income ratio greater than 450 per cent) among new borrowers fell from 19 per cent to 7 per cent, according to the most recent data. Cities with the greatest share of highly indebted borrowers before the rule change (Toronto, Vancouver, Victoria and Calgary) all saw large drops.

6 See W. Dunning, "Consumers' Perspectives on Homebuying in Canada," Mortgage Professionals Canada, June 2017.

7 See Financial Consumer Agency of Canada, "Home Equity Lines of Credit: Market Trends and Consumer Issues," *Public Research Report*, June 2017.

Some indicators suggest increasing risk among low-ratio mortgages

The recent improvement in the quality of new lending among high-ratio mortgages has shifted the focus of concern to low-ratio mortgage lending. For loans from federally regulated lenders for purchases, low-ratio mortgages have increased from about two-thirds of new lending activity in 2014 to around three-quarters in 2017, including about 90 per cent of new mortgages in Toronto and Vancouver. When measured in terms of the dollar value of lending, low-ratio mortgages are even more prevalent. This is because low-ratio mortgages tend to be used for larger mortgages; houses priced over $1 million are not eligible for mortgage insurance, which is required for high-ratio mortgages.

As the volume of low-ratio lending increases, a portion of it is displaying riskier characteristics. The proportion of low-ratio mortgage borrowers who are highly indebted has been trending up. In addition, the share of low-ratio borrowers who are using amortization periods longer than 25 years is increasing.[8] The rise in these risk indicators has been largest in regions experiencing rapid house price growth.

The new guideline will help mitigate vulnerabilities from low-ratio mortgages

OSFI has been progressively reinforcing its expectations for sound mortgage lending by federally regulated financial institutions. The update to Guideline B-20 in October 2017 further strengthens underwriting requirements for low-ratio mortgages issued by federally regulated lenders. The new requirements will come into effect at the beginning of 2018 and will

- implement a stress test for mortgage interest rates;
- require loan-to-value measurements and limits to take into account housing market risks, especially in markets that have experienced rapid house price increases; and
- place restrictions on combining mortgages with other lending products (for example, co-lending arrangements) that may circumvent loan-to-value limits.

The mortgage interest rate stress test will have the most direct effect on underwriting standards and is expected to improve the quality of new lending by federally regulated lenders. Like the autumn 2016 changes to mortgage insurance rules, it is expected to decrease the proportion of highly indebted households among new borrowers. Areas with high price growth will be most affected (**Box 1**).

The impact of the new guideline will depend on the response of borrowers and lenders

The reactions of borrowers and lenders to the rule change are uncertain. Lenders have some flexibility to implement underwriting guidelines based on their risk appetites and a variety of risk criteria, subject to OSFI's supervision. In contrast, the autumn 2016 mortgage insurance rules set strict limits on allowable debt-service ratios. In addition, borrowers with low-ratio mortgages can opt for a longer amortization period to pass the stress test, while amortization length is capped at 25 years for high-ratio mortgages.

8 A long amortization period can be a symptom of borrowers stretching to meet their debt-service requirements. It also allows a slower paydown of mortgage principal, which can lead to less equity in the house and higher ongoing indebtedness.

Box 1

A Counterfactual Analysis of the Impact of the New Mortgage Stress Test

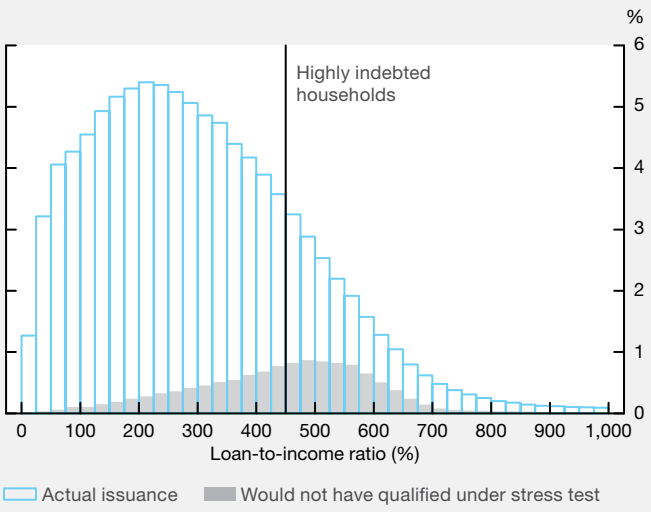
Table 1-A and Chart 1-A estimate the fraction of mortgages issued in the 12 months ending in June 2017 that would not have qualified if the new Office of the Superintendent of Financial Institutions (OSFI) stress test on low-ratio borrowers had already been in place. A similar estimate of the impact of the 2016 mortgage insurance rules on high-ratio borrowers is also provided for comparison purposes. These estimates do not include how households might change their purchase plans to stay in the mortgage market.

A smaller proportion of low-ratio borrowers is affected nationally compared with the effect on high-ratio borrowers of the autumn 2016 mortgage insurance rules. But the new OSFI guideline is having a more similar impact in value terms. This is because low-ratio mortgages make up a larger share of the overall market (Chart 3) and the average value of low-ratio mortgages is greater. The OSFI guideline has a larger value impact in cities where house prices have been growing rapidly. In addition, this impact is bigger than the impact of the 2016 mortgage insurance rules in those cities. These are the cities with a prevalence of highly indebted borrowers and low-ratio lending.

Chart 1-A shows the potential effect of the stress test nationally for borrowers at different loan-to-income ratios. The proportion of highly indebted borrowers who would not have met the stress-test requirement is more than double the overall rate, indicating that the stress test effectively targets riskier lending. The stress test does not eliminate lending to new high loan-to-income borrowers, however. Some will continue to qualify for mortgages because they have other characteristics—such as substantial housing equity and financial wealth—that lenders use when making their underwriting decisions. In addition, some borrowers with low loan-to-income ratios are affected by the new stress test because they have non-mortgage debt that pushes them over debt-service thresholds.

Chart 1-A: Estimated impact of the new OSFI stress test on highly indebted households

Issuance of low-ratio mortgages, 2016Q3 to 2017Q2



Note: Loan value is based on the outstanding portion of the mortgage and reflects loans originated for purchase by federally regulated financial institutions from 2016Q3 to 2017Q2.

Sources: Regulatory filings of Canadian banks and Bank of Canada calculations

Last observation: 2017Q2

Table 1-A: Estimated impact of the mortgage stress test

	Low-ratio[a] 2017 OSFI Guideline B-20		High-ratio[b] 2016 mortgage insurance rules	
Region	Proportion within low-ratio (per cent)	Value ($ billions)	Proportion within high-ratio (per cent)	Value ($ billions)
Nationally	10	15	31	21
In Toronto, Vancouver and surrounding areas	12	10	46	8
In other cities	8	5	28	13

a. Mortgages that would not have qualified under the OSFI mortgage stress test if it had been in place for the 12 months ending in June 2017. The estimates are based on all mortgages issued for purchase by federally regulated lenders. These calculations assume that lenders will use Canada Mortgage and Housing Corporation debt-service thresholds (including all consumer debt), that they will continue to underwrite some mortgages that exceed the debt-service thresholds and that borrowers will extend their amortization periods to qualify.

b. Uses data for the 12 months ending in September 2016 as reported in the December 2016 Bank of Canada *Financial System Review*.

Sources: Regulatory filings of Canadian banks, Finance Canada and Bank of Canada calculations

As discussed, evidence from the autumn 2016 changes to mortgage insurance rules suggests that a large portion of potential borrowers affected by the change will adjust to the new requirements by choosing to buy a less-expensive house. Others might delay a house purchase or make a larger down payment.

Another option for constrained borrowers is to seek out a lender that is not subject to the new stress test.[9] Around 17 per cent of outstanding uninsured mortgages is held by provincially regulated credit unions, which are not directly affected by the OSFI guidelines. Provincial regulators may implement the same stress test requirement. In addition, the Canada Mortgage and Housing Corporation is assessing whether additional measures are needed to control risk in low-ratio mortgages by lenders outside OSFI supervision who participate in government securitization programs.[10]

Private lenders, such as mortgage investment corporations, are also not subject to OSFI guidelines (**Box 2**). Migration of higher-risk mortgages outside the prudentially regulated financial system will be monitored.

As borrowers and lenders adapt to the new OSFI guideline, it will take some time to assess the extent to which this vulnerability is being alleviated. Based on the experience of the autumn 2016 changes in mortgage insurance rules, a material impact on new lending could take as long as six months to materialize. A significant decline in the overall vulnerability may take several years because of the large stock of outstanding debt.

Canadian borrowers will adjust over time to interest rate increases

Lenders typically offer mortgages amortized over 25 years or more, but few offer mortgages with attractive rates that are locked in for longer than 5 years. The high pricing of longer-maturity loans partly reflects legal and policy restrictions.[11] As a result, borrowers will typically lock in rates for 5 years or less and see their payments adjusted many times over the course of their 25- or 30-year mortgage amortization period.

A moderate increase in mortgage interest rates would be significant but manageable for most borrowers, especially if it is accompanied by improvements to household income. Around half of outstanding mortgages have at least one year before their interest rates are reset (**Chart 4**). When their mortgages come up for renewal, borrowers may also have higher income and more home equity to help manage these payments. For illustration purposes, consider a typical borrower who renews a loan with a remaining amortization period of 20 years. This borrower has an outstanding mortgage

9 The OSFI guideline applies only to federally regulated lenders, such as banks and trust companies, as well as to any loans that these organizations acquire from other lenders, such as mortgage finance companies.

10 Canadian lenders who participate in government securitization programs (which include most credit unions) must abide by the Canada Mortgage and Housing Corporation (CMHC) Approved Issuer Framework. See E. Siddall, "Defending the Blue Line: Financial Stability and CMHC" (speaking notes for the conference Marché de l'habitation, Grand Montréal du futur : à quoi ressemblera la carte immobilière, November 14, 2017).

11 The *Interest Act* limits the prepayment penalty that can be charged by lenders for mortgages with terms longer than five years. In addition, deposit insurance and government securitization rules are less favourable for funding mortgages longer than five years.

Box 2

Private Mortgage Lending

Private mortgage lenders are non-deposit-taking financial institutions that lend outside of the prudentially regulated financial system. A notable example is mortgage investment corporations (MICs). They are regulated at the provincial level for investor protection, although the degree of regulation varies across provinces.

Most MICs, particularly the large ones, specialize in multi-unit residential loans and commercial lending, rather than single-family mortgages. MICs that offer single-family mortgages generally specialize in lending to borrowers with higher risk characteristics (such as limited income documentation or low credit scores) and consequently charge a higher interest rate. Many MICs specialize in second mortgages, lending for debt consolidation and providing bridge loans until borrowers can access other lenders.

Ontario land registry data from Teranet suggest that the median characteristics of mortgages from MICs and other private lenders are considerably different from those of other lenders (Table 2-A). First, private mortgages charge relatively high interest rates, around seven percentage points higher than the median mortgage rate of other lenders and three percentage points higher for first mortgages. Second, the typical private mortgage has a short term, with a median of one year. Finally, the median loan size of private mortgages is smaller than that of other mortgages.

Table 2-A: Median characteristics of private mortgages on single-family homes in Ontario, 2013Q1–2017Q3

	Private lenders	Other lenders
Loan term (years)	1	5
Interest rate (per cent)	10	3
Loan size ($)	95,000	305,000

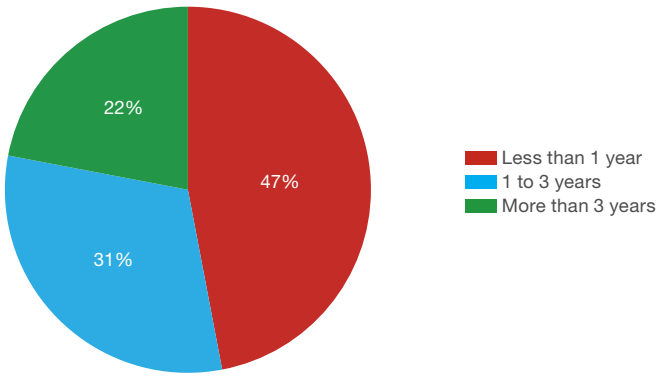
Notes: Includes mortgages for purchases and refinances. Other lenders include banks, credit unions and mortgage finance companies. Private lenders include mortgage investment companies and other non-prudentially supervised lenders.
Source: Teranet

MICs and other private lenders accounted for around 10 per cent of all new residential mortgages, including purchase and refinance activity, in Ontario in 2017. But, because private loans are small, on average, private lending amounted to around 6 per cent of the value of new residential mortgages. And since private loans have shorter terms than other loans, they are less important in the stock of outstanding mortgages. Co-lending arrangements were a small portion of the private lending activity.[1]

The total assets of MICs remain relatively small (roughly between $10 billion and $15 billion nationally). Under their current business models, it is unlikely that MICs will attract a significant share of borrowers affected by more stringent qualifying rules. To expand beyond their niche, these lenders would need to further develop their lending channels and, most importantly, develop larger funding sources. Their small share of the mortgage market, limited leverage and risk-based pricing reduce the possibility that MICs will exacerbate financial system vulnerabilities in the short term. Nonetheless, developments in private lending will be closely monitored.

1 A co-lending arrangement (or bundled mortgage) is a mortgage product that combines a first mortgage (typically from a traditional lender) and a second mortgage (typically from a private lender) secured against the same property. One technique for identifying co-lending in the data is to look at cases where two mortgages are applied to the same property within a two-week window.

Chart 4: Length of time until interest rate resets



Note: Data are from the Big Six Canadian banks, which are the Bank of Montreal, Canadian Imperial Bank of Commerce, National Bank of Canada, Bank of Nova Scotia, Royal Bank of Canada and Toronto Dominion.
Sources: Regulatory filings of Canadian banks and Bank of Canada calculations
Data observed on July 31, 2017

of around $225,000 and a gross income of approximately $90,000.[12] If mortgage rates increase by one percentage point, the monthly payments on the mortgage would increase by $115, which represents about 1.5 per cent of income.

Highly indebted borrowers would be more affected by changes in interest rates. A typical highly indebted borrower has an outstanding mortgage of approximately $360,000 and gross income of around $63,000.[13] A one-percentage-point increase in mortgage rates would increase monthly payments by $180, around 3.5 per cent of income. The risks to individual borrowers and the financial system are partly mitigated by the fact that highly indebted borrowers are more likely to have locked in their mortgage rates for five years compared with other borrowers.

As discussed in the October 2017 Bank of Canada *Monetary Policy Report* there is uncertainty about how elevated household debt might affect the economy's response to higher interest rates through household spending and other channels. In turn, the macroeconomic response will play an important part in the evolution of financial system vulnerabilities.

Vulnerability 2: Imbalances in the Canadian Housing Market

Economic fundamentals in the Canadian housing market remain strong. In Toronto, Vancouver and their surrounding areas, employment gains and immigration continue to boost housing demand, while geographic and land-use constraints limit supply. In addition, speculative behaviour, driven by past price performance, is supporting prices, making a correction more likely in these regions.

Since the June *Financial System Review* (FSR), the housing market in the Toronto area has been going through a period of adjustment. Recent data provide some signs that it may be stabilizing. Housing finance and regional housing policies, together with higher mortgage rates, are expected to weigh on housing activity, but there is some uncertainty surrounding their impact on the vulnerability.

Toronto prices slowed national house price growth

National house price growth eased to just under 10 per cent on a year-over-year basis in October (**Chart 5**), caused by a material slowing in the Greater Toronto Area (GTA). In Vancouver and nearby cities, prices are up 14 per cent from a year ago. Combined, these two regions account for about 50 per cent of house sales by value (and 25 per cent by units sold) in Canada.

All other regions have posted a more modest pickup in prices since the June FSR. As the economic rebound in Alberta became more entrenched, house prices there rose on a year-over-year basis for the first time since 2015. Other markets, such as Ottawa and Montréal, also continued to pick up, with prices up about 6 per cent from one year ago.

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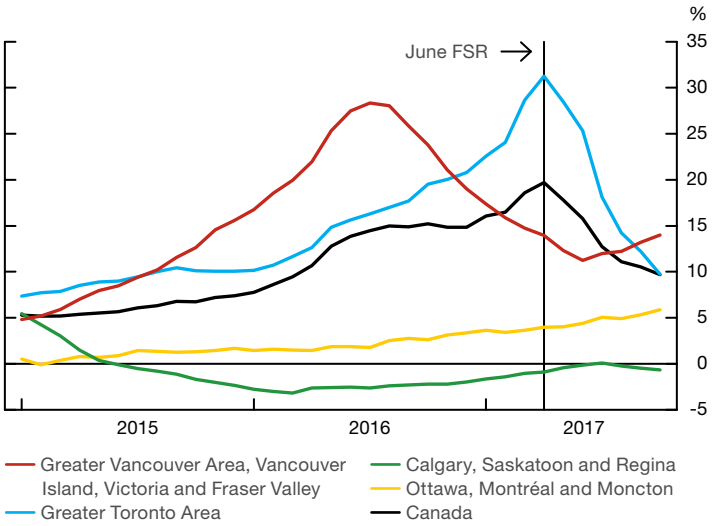
12 The mortgage size and income for the typical borrower are calculated as the median of all mortgages with loan-to-income ratios between 200 and 300 per cent. All mortgages originated (for purchase, refinance and renewal) during the 2014–16 period by federally regulated lenders are included. The 200 to 300 per cent range was chosen to include the median loan-to-income ratio.

13 For the typical highly indebted borrower, the median of all mortgages with loan-to-income ratios exceeding 450 per cent is calculated.

Chart 5: Regional differences in house price growth have decreased

Year-over-year growth in quality-adjusted benchmark prices



Note: The lines represent averages of quality-adjusted prices weighted by the population of the corresponding census metropolitan areas as defined by Statistics Canada. The June FSR line is placed to indicate the most recent data available at the time of the report, not the publication date.

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

Last observation: October 2017

Price growth is strong in Vancouver again

A slowing of housing activity in the Greater Vancouver Area (GVA) began in early 2016 and continued after the introduction of the tax on non-resident buyers. Prices troughed late in that year, but have risen since, with growth of about 16 per cent on a three-month annualized basis in October (**Chart 6**). Prices for both condominiums and single-family homes are up notably since the beginning of the year, with expectations of future price growth also picking up again.[14] Growth of condominium prices has been particularly sharp, reflecting the reduced affordability of single-family homes, as well as policies that treat lower-priced homes more favourably, such as the BC Home Owner Mortgage and Equity Partnership program.

The housing market in the Greater Toronto Area is going through a period of adjustment

After several months of rapid growth in resales and prices, house price inflation in Toronto and its surrounding area has eased, in part because of Ontario's Fair Housing Plan. The Plan notably included the introduction of a 15 per cent tax on non-resident purchases.

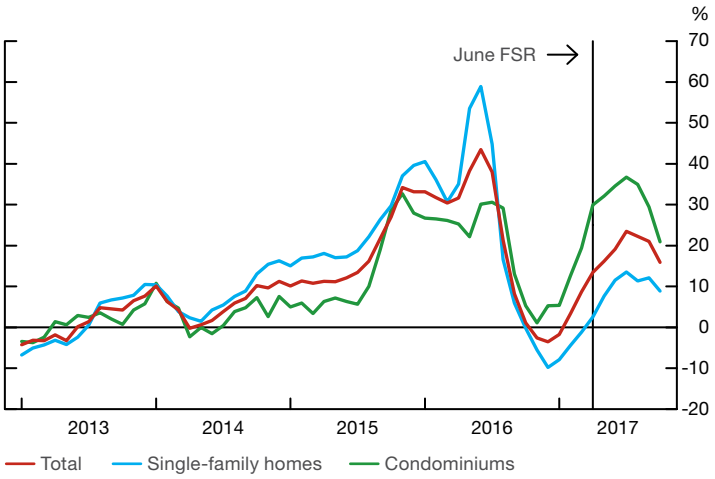
As in Vancouver, the reaction following the introduction of the tax appeared outsized relative to the estimated importance of non-resident buyers in overall activity. Resale activity fell sharply, and new listings rose. Benchmark house prices declined and are now about 8 per cent below their April values.

Along with the tax, other factors likely had an impact on the Toronto market, including the mortgage insurance measures introduced in autumn 2016. Policy measures also contributed to a change in market sentiment

14 Based on results from the Bank of Canada's Canadian Survey of Consumer Expectations (see M.-A. Gosselin and M. Khan, "A Survey of Consumer Expectations for Canada," *Bank of Canada Review* (Autumn 2015): 14–23.

Chart 6: Vancouver house price growth is led by condominium prices

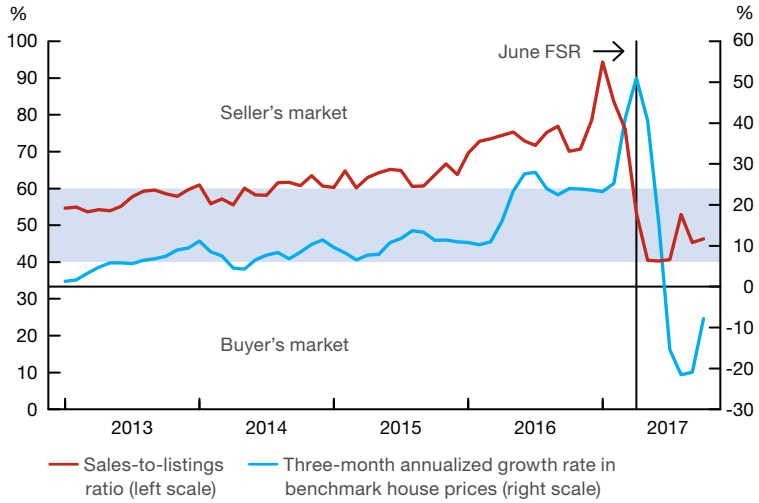
Three-month annualized growth in quality-adjusted benchmark prices



Note: Series are seasonally adjusted. Prices are for the Greater Vancouver Area. Condominiums are defined as any home that is part of a multi-unit building, including the following: single-family apartment, multi-level apartment, loft, penthouse, duplex, triplex and studio suite. The June FSR line is placed to indicate the most recent data available at the time of the report, not the publication date.

Sources: Canadian Real Estate Association and Bank of Canada calculations Last observation: October 2017

Chart 7: The Greater Toronto Area housing market has steadied in recent months



Note: Series are seasonally adjusted. The shaded area indicates where the market is roughly balanced between buyers and sellers, based on the sales-to-listings ratio. The June FSR line is placed to indicate the most recent data available at the time of the report, not the publication date.

Sources: Canadian Real Estate Association and Bank of Canada calculations Last observation: October 2017

as expectations for price growth over the next year declined sharply. The change in market sentiment was likely related to the prevalence of speculative behaviour and extrapolative expectations, which can make prices more sensitive to changes in economic fundamentals.[15]

In recent months, the sales-to-listings ratio has levelled off into a more balanced range, suggesting that the market may be stabilizing **(Chart 7)**. New condominium construction remains buoyant, and inventories remain low.

15 See Box 4 of the June 2017 Bank of Canada *Financial System Review*.

Policy measures are expected to mitigate housing market imbalances

Higher interest rates and housing-related policy measures will reduce demand for home purchases and prices relative to what they would have been otherwise. For example, the recent changes to the OSFI guideline are expected to subtract about 0.2 per cent from the level of gross domestic product (GDP) by the end of 2019.[16] In markets like the GTA and GVA, where speculative behaviour and extrapolative expectations are supporting prices, the decline in demand from higher interest rates and housing-related policy measures is also expected to help mitigate imbalances.

However, the impact of these policy measures on the market is uncertain. Foreign buyer taxes in the Vancouver and Toronto areas have reduced non-resident demand. But there is a chance that it will rebound or migrate to other Canadian cities. As discussed in Vulnerability 1, there is uncertainty about how borrowers and lenders will react to the new OSFI measures. There is also uncertainty around the sensitivity of the housing market to higher interest rates.

Vulnerability 3: Cyber Threats and Financial Interconnections

Complex information technology platforms have allowed the financial sector to deliver new services to clients and to deliver existing services more efficiently. However, the high degree of financial and operational interconnectedness among financial institutions means that a successful cyber attack against a single institution or a key service provider could spread more widely within the financial system. Cyber attacks do not respect borders: they can originate from outside Canada and be transmitted across the global network that financial institutions rely on to operate their businesses.

Collaboration among stakeholders is crucial for addressing cyber threats. The Bank is working with industry, international bodies such as the G7, and federal and provincial authorities both to enhance information sharing and to improve policies. This includes the Bank's participation on a committee with senior representatives of federal departments and agencies. This committee is coordinating the government's strategic approach to maintaining Canada's resilience in the face of cyber threats.

The Bank is working with financial market infrastructures to address cyber threats

Financial market infrastructures (FMIs) act as hubs for financial transactions. Banks and other financial institutions require direct or indirect connections to them to enable the safe and efficient exchange of funds, securities and other financial products. FMIs designated for oversight by the Bank of Canada are required to meet the Bank's standards for addressing operational risk, including cyber risk. This oversight includes requirements to assess their cyber resilience against international standards.

In addition to establishing policies and processes to reduce the risk that an FMI will be compromised by a cyber attack, it is important to focus on preparing to quickly and safely recover from a cyber disruption. To help advance this goal, the Bank of Canada has asked FMIs and their major participants to conduct exercises to demonstrate how they would respond to—and recover from—a range of cyber scenarios. These exercises will allow the Bank and the FMIs to identify issues that could affect their cyber resilience and take measures to address them.

16 See the October 2017 Bank of Canada *Monetary Policy Report*.

Payments system participants must prepare to recover from a cyber attack

In partnership with the main participants in the wholesale payments system, the Bank is leading a business-continuity initiative to support rapid recovery should a key participant be affected by a serious cyber event. The objectives of the initiative are to enhance consistency and coordination among institution-specific recovery plans, and to develop and test integrated recovery plans for the broader wholesale payments system. Scenarios being considered include a significant participant's loss of connectivity to the payments infrastructure or the corruption of payments-related data.

A collaborative approach to recovery is being examined for these scenarios, including where the corruption of critical data has resulted in a prolonged operational outage at a significant payments system participant. This could involve major Canadian banks establishing standby relationships with each other for the execution of wholesale payments activity during an operational crisis.

Other Vulnerabilities

Beyond the key vulnerabilities, the Bank of Canada monitors and assesses other vulnerabilities across the entire financial system, including those related to financial institutions, markets and the shadow banking sector. This section highlights a few specific areas that have been the focus of recent attention. Although these are not considered key vulnerabilities, the Bank continues to collect data and develop new analysis as part of its ongoing monitoring.

Brokered deposits: Some banks have focused on niche lending to non-traditional borrowers. These monoline lenders rely heavily on brokered deposits to fund uninsured mortgage lending. Despite deposit insurance and regulatory liquidity requirements, the experience with Home Capital Group earlier this year shows that concerns about a bank can lead to rapid withdrawal of this type of funding.[17] These institutions represent a relatively small share of the banking system, but their funding stress could propagate to other lenders.

Increased risk taking: Global financial markets have been characterized by low interest rates and low market volatility, creating an incentive for increased risk taking to enhance returns. This includes the use of higher leverage and investments in risky assets, such as products tied to equity market volatility (**Box 3**). A sustained increase in risk premiums, however, could force investors to delever, amplifying the shock to markets. This impact could be magnified by other channels, including liquidity mismatch and herding behaviour in some investment strategies.

Corporate indebtedness: Highly indebted corporations are more sensitive to interest rate increases or a slowdown in economic activity. Canadian non-financial corporate debt has risen by about 8 per cent per year since 2012, lifting the ratio of corporate debt to GDP to historic highs (**Chart 8**).[18] Nonetheless, firms have adequate cash buffers, suggesting that they are well positioned to meet their short-term obligations. Corporate debt-to-equity ratios also remain low, but this depends heavily on the sustainability of equity valuations.

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17 See Box 1 in the June 2017 Bank of Canada *Financial System Review*.

18 Market values of debt and equity are used, but the results are qualitatively similar for book values. Debt levels are adjusted to remove inter-affiliate lending. For more information, see T. Duprey, D. Hogg and T. Grieder, "The Recent Evolution of Canada's Credit-to-GDP Gap: Measurement and Interpretation," Bank of Canada Staff Analytical Note (forthcoming).

Box 3

Investment Strategies in a Low-Volatility Market Environment

The current period of low volatility comes in an environment of persistently low interest rates and investor confidence in the outlook for economic growth and corporate performance.[1] There is a possibility that the resulting pricing of risk is in line with fundamentals. Alternatively, if the market is characterized by complacency and risk is underpriced, it can lead investors to take on excessive exposure to risky assets, possibly by using financial leverage. The evidence that the current market is characterized by complacency is mixed. For example, while measures of short-term expectations of equity market volatility are at historical lows (Chart 1), longer-term expectations are somewhat higher.[2]

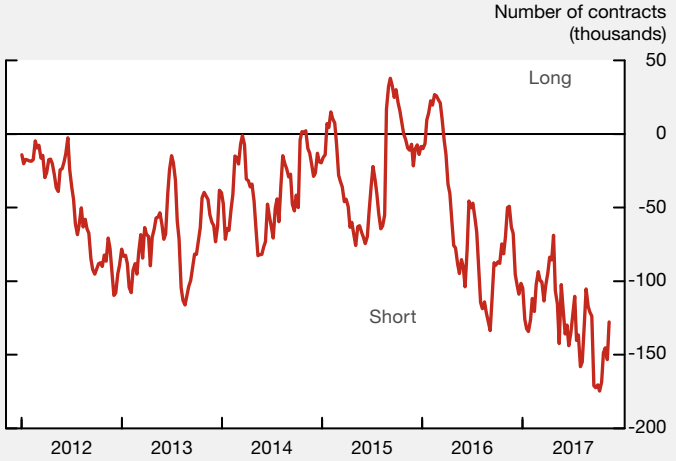
Nonetheless, a popular trade that investors have been using to enhance their returns is to take "short" VIX futures (Chart 3-A).[3] Investors earn a premium if equity market volatility decreases or does not change significantly during the 30 days following a trade. The increased popularity of this trade suggests that investor expectations of a persistent low-volatility environment have become more entrenched. Exchange-traded products have been developed that make this strategy more readily available to retail investors. Globally, positions in these and similar trades are thought to be close to US$2 trillion.[4]

There has also been an increased focus on strategies that target a certain level of volatility, including risk-parity strategies. In a risk-parity strategy, the portfolio manager attempts to maintain a target level of volatility by rebalancing asset allocations within a portfolio. A decrease in volatility often results in an increase in leverage to meet the desired target volatility.

A sharp and sustained increase in volatility could require these managers to abruptly rebalance portfolios and deleverage to maintain the predetermined risk allocation. In addition, investors betting against a rise in volatility are likely to suffer significant losses and may be forced to sell assets to cover their positions or to raise cash. Moreover, if there was a pre-existing mispricing of risk and concentrated positions, these selling pressures could increase procyclicality, leading to asset fire sales.

Chart 3-A: Short positions in equity volatility have increased

Net positions in VIX futures by non-commercial accounts



Source: Commodity Futures Trading Commission through Bloomberg Finance L.P.

Last observation: November 14, 2017

1 International Monetary Fund, *Global Financial Stability Report*, October 2017.

2 See D. Lucca, D. Roberts and P. Van Tassel, "The Low Volatility Puzzle: Is This Time Different?" *Liberty Street Economics*, November 15, 2017.

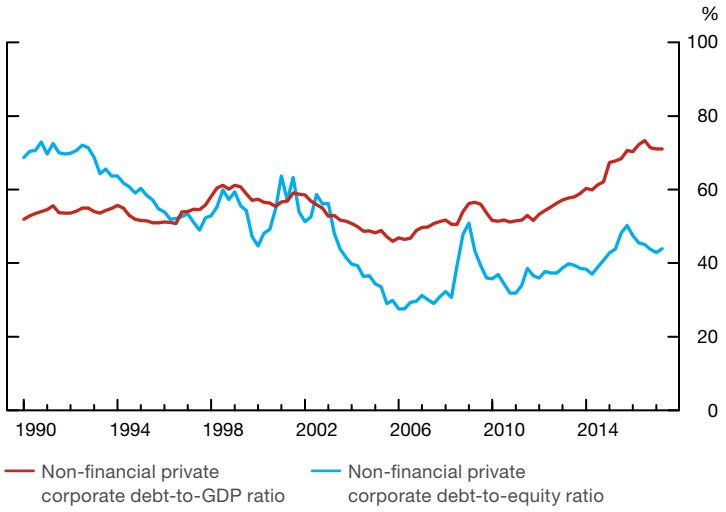
3 The VIX index is the most widely used measure of implied volatility; a low level indicates that market participants do not expect significant changes in equity prices over the next 30 days.

4 G. Banerji, "Will Short Volatility Trigger the Next Black Monday?" *Wall Street Journal*, October 19, 2017.

In addition, there has been noticeable growth in debt denominated in foreign currencies, especially for financial institutions. Funding in different currencies allows firms to diversify funding sources and supports the growth of foreign assets. But if foreign currency debt is funding assets denominated in Canadian dollars, there is the possibility of losses from a persistent depreciation of the Canadian dollar. Firms are also vulnerable to rollover risk if foreign creditors choose not to renew their investments in Canadian firms.[19]

19 See G. Bruneau, M. Leboeuf and G. Nolin, "Canada's International Investment Position: Benefits and Potential Vulnerabilities," Bank of Canada *Financial System Review* (June 2017): 43–57.

Chart 8: The ratio of non-financial corporate debt to GDP has increased, but the debt-to-equity ratio remains low



Note: Private corporate debt refers to the market value of debt, excluding inter-affiliate corporate loans.
Sources: Statistics Canada and Bank of Canada calculations Last observation: 2017Q2

Retail sector of commercial real estate: Structural changes in the retail market, such as growth in online commerce, are having an adverse impact on the commercial real estate market in Canada. Recent store closures (including Sears, Target and Future Shop) are putting some upward pressure on vacancy rates. Banks' overall exposure to non-residential mortgage loans is diversified, with only a small percentage of loans to retail developments. Other investors may be more exposed, however, including through real estate investment funds.

Reliance on third-party service providers: As financial services rely increasingly on information technology, there are growing operational risks from third-party service providers. Since providing services such as cloud computing, big data analytics and artificial intelligence requires a critical mass of users to remain cost-effective, global markets could become dominated by a few large technology firms. Higher industry concentration would raise systemic risks from operational disruptions and cyber attacks. Investments by service providers to avoid disruptions have benefits beyond the individual firm and can be considered a public good.[20] A recent report by the Financial Stability Board identified this as a priority and suggested that financial sector authorities need to coordinate across borders and with non-traditional partners to establish appropriate oversight frameworks.[21]

20 See T. Cowen, "Public Goods," *The Concise Encyclopedia of Economics*, 2008.

21 See Financial Stability Board, "Financial Stability Implications from FinTech: Supervisory and Regulatory Issues that Merit Authorities' Attention," June 27, 2017.

Key Risks

Table 1 examines risk scenarios for the Canadian financial system in which vulnerabilities transmit and amplify trigger events (or shocks), resulting in adverse effects on the financial system and the economy. The purpose is to identify the most important downside risks rather than all possible negative scenarios. Each risk includes an overall risk rating based on Governing Council's judgment regarding the probability of the risk occurring and the expected severity of the impact on the Canadian financial system if it were to materialize. While overall risks to the Canadian financial system remain elevated, some risks have eased since the June FSR.

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

Risk scenarios	Ratings and developments since the June 2017 FSR
Risk 1: A severe nationwide recession leading to a rise in financial stress ▪ A large, persistent, negative foreign demand shock leads to a severe recession with a sharp rise in unemployment nationwide and a correction in house prices. ▪ Household and housing market vulnerabilities interact to create stress for lenders and the broader financial system.	**Elevated but decreasing** ▪ Stronger employment growth in Canada has increased the resilience of households. ▪ The quality of high-ratio mortgage lending has improved significantly. ▪ The new guideline for mortgage underwriting will help mitigate vulnerabilities associated with low-ratio mortgages.
Risk 2: A house price correction in overheated markets ▪ There are significant house price corrections 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.	**Moderate** ▪ Policy measures are expected to weigh on credit growth and house prices in Toronto, Vancouver and surrounding areas, but the extent of their impact is uncertain. ▪ House prices in Toronto have declined somewhat from their April peak. Recent data suggest that the housing market may be stabilizing. ▪ Demographic demand in these areas remains strong.
Risk 3: A sharp increase in long-term interest rates driven by higher global risk premiums ▪ Market reactions to unexpected changes in monetary policy or prospects for global growth or inflation trigger a large and persistent increase in interest rates driven by a rise in global risk premiums.	**Moderate but increasing** ▪ Persistently high asset valuations and low market volatility create conditions that could amplify a downturn. ▪ Global economic growth continues to strengthen and expand. ▪ Market reactions to the balance-sheet reduction by the US Federal Reserve and the announced slowdown in asset purchases by the European Central Bank have been muted.
Risk 4: Stress emanating from China or other emerging-market economies (EMEs) ▪ A severe financial disruption in China or other EMEs triggers weaker global growth and a rise in financial market volatility. ▪ Stress transmits to Canada through commodity prices, trade channels and a rise in global risk premiums.	**Elevated but decreasing** ▪ Economic activity in China has been somewhat stronger than anticipated, and portfolio capital flows to EMEs have generally been strong. ▪ Chinese authorities continue to take encouraging steps to address financial system vulnerabilities. The steps, if effective, will increase financial system resilience.

Risk ratings:	Low	Moderate	Elevated	High	Very high

Safeguarding the Financial System

Table 2 summarizes the progress made by Canadian authorities since the December 2016 FSR in implementing policies to increase the resilience of the financial system.

Table 2: Canada's progress on implementing regulatory reforms in 2017

Building resilient financial institutions	
Risk-based capital regulations	The Office of the Superintendent of Financial Institutions (OSFI) implemented a new capital requirement for federally regulated mortgage insurers that takes borrower risk characteristics and housing market valuations more fully into account. OSFI announced that the timeline for Canada's implementation of the minimum capital requirements for market risk rules (also known as the Fundamental Review of the Trading Book) will be extended by one year, to the first quarter of 2021 at the earliest. See T. Gomes, S. King and A. Lai, "Shoring Up the Foundations for a More Resilient Banking System: The Development of Basel III," in this issue. OSFI finalized its Guideline A: Life Insurance Capital Adequacy Test, which will come into effect on January 1, 2018.
Liquidity standards	OSFI announced that implementation of the Net Stable Funding Ratio has been delayed by one year, until January 2019. This decision was made because of uncertainty that key foreign jurisdictions will follow the previously agreed international timeline. The Basel Committee on Banking Supervision assessed Canada's implementation of the Liquidity Coverage Ratio as compliant, which is the highest possible grade.
Ending "too big to fail"	
Recovery plans	The Big Six federally regulated Canadian banks and selected smaller banks submit their recovery plans on a regular basis. One large insurance company submitted its first recovery plan in November 2017. Financial market infrastructures (FMIs) are making enhancements to their first-generation recovery plans.
Bail-in regime	Federal authorities are expected to issue in early 2018 regulations and guidelines to operationalize the bail-in regime. Toward the summer of 2018, the Big Six banks are expected to start issuing debt subject to bail-in (i.e., debt that could be converted to equity, if necessary, to recapitalize a bank).
Resolution regimes	Federal authorities are working on a Canadian resolution regime for designated FMIs. The Big Six banks are expected to submit revised bank-authored resolution plans in late 2017.
Making derivatives markets safer	
Clearing through central counterparties	A provincial clearing mandate for participants in large derivatives and requirements to protect customer collateral came into force.
Margin requirements	OSFI is continuing the phase-in of mandatory collateral exchange for trades not centrally cleared, on an internationally agreed timeline. Provincial securities regulators expect to publish a draft margin rule in early 2018.
Reporting to trade repositories	Certain transactional data (including on price and size) are now made public on the websites of trade repositories within two days of a transaction.
Completing derivatives reforms	Provincial securities regulators published a draft business conduct rule for derivatives market participants. Securities regulators also expect to publish a draft registration rule for derivatives dealers in 2018.
Enhancing the oversight and regulation of the shadow banking sector	
Assessing risks from shadow banking	Canadian authorities continue to monitor vulnerabilities associated with shadow banking activities, including through participation in global monitoring by the Financial Stability Board. Work continues on improvements to the granularity and reliability of data on shadow banking entities and activities.
Strengthening core funding markets	The Canadian Derivatives Clearing Corporation announced enhancements to its central counterparty repo (repurchase) service that will enable Crown corporations and public sector pension funds to become clearing members. This initiative will bolster the resilience of repo markets, while providing participants with important netting and balance-sheet efficiencies. The onboarding of this new type of participant is expected to begin in early 2018, subject to public consultation and regulatory approval.

(*continued...*)

Table 2: Canada's progress on implementing regulatory reforms in 2017 (*continued*)

Other domestic regulatory initiatives	
Risks from financial technology (fintech)	The Canadian Securities Administrators launched the Regulatory Sandbox, which provides a faster and more flexible regulatory process for fintech companies. This allows them to test their products, services and applications throughout Canada. Canada's Competition Bureau is expected to publish a market study analyzing the competitive impact of fintech in the Canadian financial system and providing recommendations on whether there is a need for regulatory reform. The Department of Finance is drafting regulations for the cryptocurrency market that will primarily cover the application of anti-money-laundering and counter-terrorism financing rules.
Systemic risk in capital markets	The Court of Appeal of Quebec rendered its decision concerning the constitutionality of the proposed Cooperative Capital Markets Regulatory System. The Court held that the proposed co-operative model defining power sharing between the federal government and the participating provinces is unconstitutional. But the draft *Capital Markets Stability Act*, which addresses systemic risk, national data collection and criminal law and would apply across the country, would be constitutional if the provisions concerning the proposed co-operative model were removed. Canada, British Columbia and Quebec filed notices of appeal with the Supreme Court of Canada. A hearing is tentatively scheduled for March 2018.
Retail payments oversight framework	The Department of Finance published "A New Retail Payments Oversight Framework: A Consultation Paper." The goal of the proposed framework is to ensure that payment services remain reliable and safe and that the payments system is conducive to the development of faster, cheaper and more convenient methods of payment. The framework would apply to any entity that performs a payment function in the context of electronic fund transfers. It is proposed that payment service providers subject to oversight comply with measures related to operational and financial risk management, as well as those related to market conduct. The Department of Finance is currently reviewing stakeholder feedback to refine its proposed policy.

Reports

Reports present work by Bank of Canada staff on specific financial sector policies and on facets of the financial system's structure and functioning. They are written with the goal of promoting informed public discussion on all aspects of the financial system.

Introduction

This issue of the *Financial System Review* features two reports.

Analysis of Household Vulnerabilities Using Loan-Level Mortgage Data, by Olga Bilyk, Alexander Ueberfeldt and Yang Xu, examines detailed data on home mortgages to provide a better understanding of the vulnerabilities associated with the mortgage market. The authors find that the proportion of low-ratio mortgages is growing, particularly in regions with strong house price growth. Moreover, these borrowers exhibit less flexibility to adverse shocks, since they have high debt levels relative to income and have taken mortgages with long amortization periods.

In **Shoring Up the Foundations for a More Resilient Banking System: The Development of Basel III**, Tamara Gomes, Sheryl King and Alexandra Lai trace the development of the Basel III standards for banking regulation. They show how Basel III builds on two earlier frameworks, in response to weaknesses revealed during the global financial crisis. The authors highlight how implementation of the standards will underpin greater financial stability and provide a sound foundation for economic growth.

Analysis of Household Vulnerabilities Using Loan-Level Mortgage Data

Olga Bilyk, Alexander Ueberfeldt and Yang Xu

- Mortgage debt is a primary contributor to high household indebtedness—a key vulnerability of the Canadian financial sector. To better understand vulnerabilities coming from the mortgage market, we examine data from individual mortgage loans from 2014 to 2016.
- The proportion of new mortgages for purchase with a loan-to-value ratio of 80 per cent or less is increasing. This rise is highly concentrated in regions with strong house price growth, such as Toronto and Vancouver and their surrounding areas.
- Among these mortgages, a growing share have high loan amounts relative to income, as well as longer amortization periods. All else being equal, households with mortgages that have these two characteristics are more vulnerable in the event of a major adverse shock to household income.
- These trends are more pronounced among younger households. They are also concentrated in regions with imbalances in the housing market.

Introduction

Mortgage debt has been the main driver behind the increasing Canadian household indebtedness over the past decade. Various factors are underpinning this credit expansion, including demographic demand, low borrowing rates, improved access to credit and strong growth in house prices in some major markets. A better understanding of mortgage products and borrowers helps us improve our assessment of the underlying financial system vulnerabilities.

More specifically, this report focuses on the loan-to-value ratio (LTV), loan-to-income ratio (LTI) and amortization period for new mortgages used to purchase residential properties. The analysis in this article relies on loan-level data from 18 federally regulated financial institutions from 2014 to 2016 (**Box 1**).

Analyzing the characteristics of mortgage holders by age, income and location helps identify the most vulnerable groups, namely those that are more likely to experience financial stress in the face of an adverse shock, such as a widespread decline in income, a sharp rise in mortgage borrowing costs or a correction in house prices.

Box 1

Description of the Loan-Level Mortgage Data

The data include only federally regulated lenders. They exclude credit unions and caisses populaires, which are provincially regulated, as well as mortgage investment companies, mortgage finance companies and other private lenders. The largest portion of excluded mortgages are insured mortgages because many of the lenders that are not federally regulated focus on issuing this type of mortgage.

We focus on the most uniform set of mortgage products: mortgages for property purchases, excluding refinances and renewals. A portion of the purchase loans are readvanceable mortgages, which combine a mortgage with a home equity line of credit (HELOC). Our analysis is based only on the mortgage component of the purchase loan and assumes that HELOCs are not drawn at origination. We also exclude insured low-ratio mortgages.[1] These mortgages may have different vulnerability characteristics and account for a small portion of purchase loans (about 3 per cent). Finally, fewer than 1 per cent of purchases have no loan-to-value information and are therefore omitted.

The final sample consists of a total of 1.3 million mortgages for properties purchased between 2014 and 2016.

1 Transactional mortgage insurance can be voluntarily taken out by lenders for low-ratio mortgages at origination. Lenders tend to use this insurance for narrow categories of mortgages with different risk characteristics. A small number of mortgages that are portfolio-insured at origination are also excluded from our sample.

This report aims to complement the analysis in the *Financial System Review* Assessment of Vulnerabilities and Risks, as well as previous reports analyzing vulnerabilities associated with mortgage holders, including Cateau, Roberts and Zhou (2015) and Crawford and Faruqui (2011–12). This report differs from earlier ones by examining new mortgages used to make purchases rather than the outstanding household debt as captured by Ipsos in its *Canadian Financial Monitor*. This allows us to understand the recent evolution of vulnerabilities centring on the most important borrowing decision made by households. Our data cover only a fraction of lenders' portfolios, however, and do not allow us to assess their overall underwriting or risk-management processes.

In this report, we first discuss how LTV relates to the characteristics of borrowers. We also show that high-LTV mortgages have decreased in importance. We then describe different ways to measure vulnerabilities in the mortgage market, how these relate to borrower characteristics and how they are changing over time.

Segmenting the Mortgage Market by Loan-to-Value Ratio

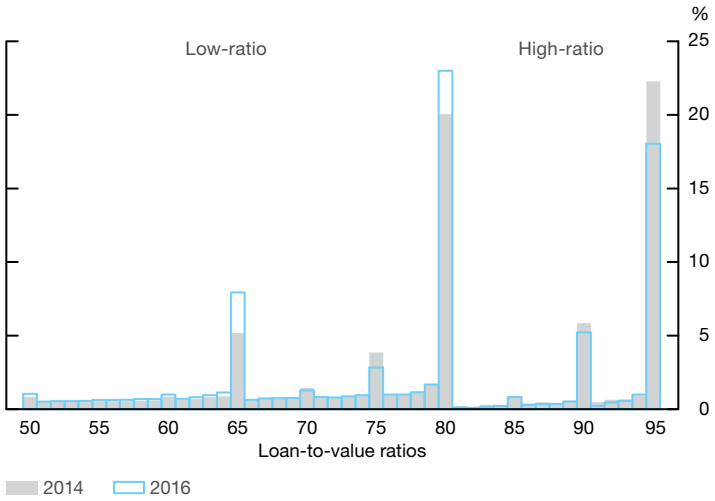
The Canadian mortgage market can be divided into high- and low-ratio segments based on LTVs (**Table 1**). High-ratio mortgages—which federally regulated lenders are required to insure—are subject to stringent rules-based mortgage insurance underwriting criteria that determine when a loan can be granted. Low-ratio mortgages have somewhat more flexible underwriting rules based on the risk appetites of individual lenders, although federally regulated lenders must operate within principle-based underwriting guidelines established by the Office of the Superintendent of Financial Institutions (OSFI). We exclude low-ratio mortgages with voluntary insurance because they likely have different risk characteristics than other low-ratio mortgages (**Box 1**).

Table 1: High-ratio and low-ratio mortgages originated by federally regulated lenders

	High-ratio mortgages	Low-ratio mortgages
Loan-to-value ratio	Above 80 per cent	At or below 80 per cent
Minimum down payment	5 per cent on portion of purchase price up to $500,000 and 10 per cent on remainder	20 per cent
Mortgage insurance	Required	Optional
		The rows below assume no insurance
Underwriting requirements	Mortgage insurance rules and OSFI guidelines B-20 and B-21	OSFI guideline B-20
Eligible purchase price	Less than $1 million	No regulatory limit
Maximum amortization period	25 years	No regulatory limit—banks typically impose a maximum of 30 years
Debt-service requirements	Strict limits on payment amounts relative to income	No regulatory limit—based on lenders' risk appetites with exceptions allowed

Note: OSFI stands for Office of the Superintendent of Financial Institutions.

Chart 1: Distribution of loan-to-value ratio for new mortgages used for purchases, 2014 and 2016



Note: 14 per cent of mortgages with a loan-to-value ratio below 50 per cent are not presented in the chart.
Sources: Regulatory filings of Canadian banks and Bank of Canada calculations

Chart 1 shows that borrowers often choose the loan with the largest possible LTV in either the high- or the low-ratio segment, given their wealth and ability to service debt. Borrowers may choose an 80 per cent LTV loan rather than a larger high-ratio loan to avoid the extra fees paid for mortgage insurance, to avoid the more stringent income qualification criteria required for high-ratio mortgages, or to buy a house priced at or above $1 million, which is not eligible for mortgage insurance.

There is a notable cluster of borrowers with an LTV of 65 per cent. OSFI guidelines require that federally regulated lenders have a maximum LTV of 65 per cent when a loan does not conform to a lender's typical underwriting policies. For example, the borrower may have weaker income documentation, imperfect credit history, high debt-service ratios or a property with characteristics that may lead to elevated credit risk. For these mortgages, lenders focus on other underwriting criteria to assess the borrower's ability to repay, such as borrower wealth. The 65 per cent LTV group may also include some borrowers accessing specific lending products that are restricted to this LTV threshold.

Regional and life-cycle determinants of mortgage choice

Low-ratio mortgages are more common in markets with strong house price growth (**Table 2**).[1] This reflects a larger share of houses priced at $1 million or greater, as well as the fact that the strict debt-service constraints on high-ratio mortgages are more often binding for insured mortgages in strong housing markets.

The age distribution of mortgage originations for home purchases reflects the life-cycle profile of home ownership.[2] Households under the age of 35 represent close to half of the high-ratio borrowers, but less than one-quarter of low-ratio mortgages, because they are less likely to have sufficient savings for the minimum 20 per cent down payment.[3] However, borrowers in

Table 2: Socio-demographic characteristics of mortgage borrowers, 2014 to 2016 (per cent)

Category	High-ratio mortgages	Low-ratio mortgages				
		All	LTV = 80%	65% < LTV < 80%	LTV = 65%	LTV < 65%
All	31	69	22	16	7	24
Region						
Strong house price growth	24	50	46	48	73	49
Modest house price growth	76	50	54	52	27	51
Age						
< 35	49	23	31	24	26	15
35 to 44	27	28	30	30	27	26
45 to 54	15	27	23	27	29	30
55 to 64	6	15	12	14	13	20
≥ 65	2	6	4	5	5	9
Household income						
1st (lowest income)	22	19	15	18	24	22
2nd	25	18	18	19	15	16
3rd	23	19	20	19	15	17
4th	19	20	22	20	17	19
5th (highest income)	11	24	24	24	29	25

Notes: The thresholds for the gross approval income quintiles in the 2016 mortgage originations data are (1st) less than $58,600, (2nd) $58,600 to $81,100, (3rd) $81,100 to $108,000, (4th) $108,000 to $153,700, and (5th) $153,700 and above. Areas with strong house price growth include Toronto and Vancouver census metropolitan areas and forward sortation areas with at least 15 per cent year-over-year gains in any year between 2014 and 2016, based on the Teranet–National Bank House Price Index™. All percentages are calculated using equal weights. LTV means loan-to-value ratio.

Sources: Regulatory filings of federally regulated financial institutions and Bank of Canada calculations

1 For a breakdown of mortgages by LTV for selected Canadian cities, see Table A-1 in the Appendix.

2 For a discussion of the life-cycle choices of Canadians related to home ownership, see Hou (2010) and Rea, MacKay and LeVasseur (2008).

3 Homeowners generally have a higher income than renters in the same age group. This also implies that the thresholds for income quintiles are higher than in the general population.

the low-ratio space in Toronto are somewhat younger compared with those in the low-ratio space overall. Younger borrowers from regions with modest house price growth are common in the cluster of low-ratio mortgages at an LTV of 80 per cent, thereby avoiding extra charges for mortgage insurance.

As households age, more people enter the housing market and others upgrade in terms of quality or size. Increased wealth and income may allow for a larger down payment, which is reflected in a higher likelihood of borrowing with a low-ratio mortgage. Older borrowers are relatively more prevalent in mortgages with an LTV under 65 per cent.

Recent movement from high- to low-ratio mortgages

Low-ratio mortgages have become more prevalent over time and accounted for 72 per cent of new home purchases in 2016, up from 67 per cent in 2014 (**Table 3**). The initial level and the increase are somewhat larger, rising from 70 to 76 per cent, when we take into account the dollar value of mortgages.

Rising housing market imbalances in Toronto, Vancouver and their surrounding areas contributed to this shift in two ways. First, an increasing share of housing market activity was concentrated in areas with strong house price growth. While 40 per cent of all mortgages were issued in these areas in 2014, this share increased to 44 per cent by 2016. Importantly, areas with strong house price growth have historically had a higher share of low-ratio mortgages than other areas. Second, within these strong house price growth areas, the share of low-ratio mortgages increased from 80 per cent in 2014 to 85 per cent in 2016. One important reason is the increasing share of homes in Toronto and Vancouver priced at $1 million or greater, which nearly doubled in the mortgage origination data from 13 per cent in 2014 to 25 per cent in 2016. Additionally, the upward

Table 3: Share of low-ratio mortgages across socio-demographic characteristics of borrowers, 2014 and 2016 (per cent)

	Share of low-ratio mortgages within category	
Category	2014	2016
All	67	72
Region		
Strong house price growth	80	85
Modest house price growth	59	61
Age		
< 35	49	55
35 to 44	69	71
45 to 54	80	82
55 to 64	84	85
≥ 65	89	89
Household income		
1st (lowest income)	65	66
2nd	59	61
3rd	62	65
4th	67	73
5th (highest income)	80	87

Note: All percentages are calculated using equal weights.
Sources: Regulatory filings of federally regulated financial institutions and Bank of Canada calculations

shift in the distribution of house prices also raised the income required to satisfy the debt-servicing criterion for high-ratio mortgages.[4] Thus, some households might have chosen to take low-ratio mortgages to alleviate debt-service constraints. Outside the regions where house price growth was high, the share of low-ratio mortgages increased only slightly, remaining near 60 per cent.[5]

Persistently strong house price growth has also shaped the increase of low-ratio mortgages among different age and income groups. Between 2014 and 2016, we see an increasing share of low-ratio mortgages across nearly all age cohorts. This trend is most pronounced for the under-35 age group. The move by the youngest households to a low-ratio mortgage helped them relax their debt-service constraints but required a larger down payment, which could come from a number of sources. One source of down payments has been family, with first-time homebuyers receiving 18 per cent of the down payment from family over 2014–16.[6]

Regional differences also explain a more pronounced shift to low-ratio mortgages among richer households, as the increase by 7 percentage points of the low-ratio mortgage space among top income quintiles is largely driven by a bigger presence of high-income borrowers in the Ontario and British Columbia housing markets.

Measuring Vulnerabilities in the Mortgage Market

We focus on the possibility of systemic risk originating in the mortgage market. In particular, we are interested in the implications of a notable rise in unemployment, higher mortgage interest rates and a sharp correction in house prices.[7]

As a result of changes to mortgage financing policy announced in autumn 2016, there was a significant drop in the volume of new high-ratio mortgage originations, as well as a sharp decline in the share of high-ratio, high-LTI mortgages. This can be seen initially in the data from the fourth quarter of 2016, but most prominently in 2017 after the end of the data used in this analysis (see Assessment of Vulnerabilities and Risks in this *Financial System Review*). In contrast, both the volume of new low-ratio mortgages and the share of low-ratio, high-LTI mortgages have continued to increase. Given these developments, the remainder of the analysis focuses on vulnerabilities in the low-ratio mortgage market.[8]

Three metrics are considered in assessing the vulnerability of new low-ratio mortgages.

Loan-to-income ratio

All else being equal, mortgages with higher LTIs are more vulnerable to financial stress, i.e., there is an increased likelihood of mortgage arrears in the event of an adverse income shock or a rise in mortgage interest

4 Both high and low gross debt-service ratios have become more common in Toronto and Vancouver with little effect on the average. The increase in mortgages with high debt-service ratios is mostly associated with rising house prices.

5 For the share of low-ratio mortgages for selected Canadian cities, see Table A-2 in the Appendix.

6 Mortgage Professionals Canada, *Annual State of the Residential Mortgage Market in Canada, Fall 2016 Survey Report.* In addition, the *2017 Mortgage Consumer Survey* from Canada Mortgage and Housing Corporation confirms the importance of family support for first-time homebuyers.

7 See Risk 1 and Risk 2 in the June 2017 Bank of Canada *Financial System Review*, Assessment of Vulnerabilities and Risks section.

8 For details regarding the most recent changes to the OSFI Guideline B-20, see the Assessment of Vulnerabilities and Risks in this *Financial System Review*.

rates. Cateau, Roberts and Zhou (2015) find that this relationship is most pronounced for households with the highest LTI. We use the share of mortgages with an LTI greater than 450 per cent to identify the most vulnerable borrower group.[9] A high LTI also suggests that, in the presence of an aggregate adverse income shock, affected households are more likely to reduce non-housing-related expenditures, with negative implications for aggregate consumption.[10]

There are several other possible measures of borrowers' ability to pay, including debt-service ratios and credit scores. We focus on LTI because it can be consistently calculated in our data and it provides a good through-the-cycle assessment of the vulnerability of borrowers.

Amortization period

A longer amortization period reduces monthly payments, creating more financial flexibility in the short term. But a long amortization also allows a slower paydown of mortgage principal, which can lead to less equity in the house and higher ongoing indebtedness. Longer amortization periods can also be a symptom of borrowers stretching to meet their debt-service requirements. If borrowers select a long amortization period with a monthly payment they can just afford, they are more vulnerable if there is an adverse income shock because they do not have the flexibility to extend the amortization further to reduce these payments.

Some households can afford prepayments that, by reducing the amount of the mortgage principal, shorten the amortization. By looking only at amortization at the time a mortgage is issued, we assess the worst-case scenario where no prepayments occur.

Loan-to-value ratio

Mortgages with lower LTVs are less vulnerable to financial stress from two perspectives. First, lenders are more likely to recover the loan value after a default, even if house prices have declined. Second, borrowers have more equity available to cushion financial stress, for example, by taking out a second mortgage or selling their home.

The vulnerability from high-LTV mortgages can be amplified by housing market imbalances, which are likely highest in the regions with strong house price growth, most notably Vancouver, Toronto and their surrounding areas.[11] Strong economic fundamentals in these regions make them relatively resilient to income shocks, but there is a higher probability of house price declines that might erode mortgage equity among recent homebuyers.

The LTV is also less effective at mitigating vulnerabilities if part of the down payment is borrowed rather than obtained from savings or friends and family.[12]

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9 Cateau, Roberts and Zhou (2015) find a stronger relationship between LTI and future arrears at an LTI threshold of 350 per cent. We choose the higher threshold because we look at new debt rather than the stock of existing debt.

10 See Baker (forthcoming) for an assessment of how household leverage modifies the consumption response to income shocks.

11 See Vulnerability 2 in the Assessment of Vulnerabilities and Risks section in this *Financial System Review.*

12 See the June 2017 Bank of Canada *Financial System Review,* Assessment of Vulnerabilities and Risks section, Vulnerability 1.

Variation in mortgage vulnerabilities across households

Loan-to-income ratio and amortization period across households

The share of low-ratio mortgages with an LTI above 450 per cent is greatest in markets with strong house price growth, among households younger than 35 and for low-income earners (**Table 4**).[13] A similar pattern emerges for the incidence of extended amortizations.

In regions with strong house price growth, 31 per cent of low-ratio mortgages had a high LTI in 2016, compared with 12 per cent in the rest of the country. Extended amortization is also more prevalent in regions with strong house price growth where housing market vulnerabilities are high, with the highest share, 79 per cent, in Vancouver.[14]

LTIs generally decrease with age as the share of high-LTI mortgages declines from 29 per cent among the youngest borrowers to 17 per cent among the 55–64 age group. One notable exception is the category of 65 years and older, which has a 21 per cent share of high-LTI mortgages. This is largely due to lower incomes in retirement. Similarly, the share of mortgages with extended amortization periods declines somewhat with age.

The share of high-LTI mortgages is the lowest among households in the top income quintile and the highest for the bottom income quintile, making the latter group particularly vulnerable to income shocks.

Loan-to-value ratio across households

Low-LTV borrowers create fewer vulnerabilities for lenders, all else being equal, because of their larger equity cushion. Given this equity cushion, borrowers face different underwriting standards. Among the 65 per cent LTV group, for example, some borrowers have no income reported in the data. In these cases, lenders focus underwriting decisions on other factors, including borrower wealth. Among those with reported income, this group has the highest proportion of borrowers with an LTI greater than 450 per cent of any LTV group (**Table 4**).

Mortgages with an LTV of 80 per cent are more closely scrutinized by lenders because they have the maximum possible LTV without requiring mortgage insurance, resulting in a larger expected loss in the event of a default. While this segment has a low proportion of high-LTI borrowers, it accounts for close to one-third of low-ratio mortgages. Moreover, 46 per cent of mortgages in this segment stem from areas with strong growth in house prices (**Table 2**).

Mortgages with an LTV between 66 and 79 per cent have a somewhat greater incidence of high LTIs and are almost equally present in regions with high and moderate price growth. Since these mortgages combine high LTI with moderately high LTV, they present elevated overall vulnerabilities.

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13 The high-LTI share calculations in Table 4 differ from those used in Table 1 of the June 2017 Bank of Canada *Financial System Review*. The current table includes all federally regulated financial institutions and excludes mortgage refinancing.

14 Table A-3 in the Appendix presents the share of high-LTI mortgages as well as the share of mortgages with extended amortization for selected Canadian cities.

Table 4: Characterizing vulnerabilities in low-ratio mortgages, 2014 and 2016 (per cent)

	Share of low-ratio mortgages with LTI greater than 450 per cent		Share of low-ratio mortgages with amortization greater than 25 years	
Category	2014	2016	2014	2016
All—by count	16	22	53	62
All—by value	23	32	62	72
Region				
Strong house price growth	23	31	67	75
Modest house price growth	9	12	40	47
Age				
< 35	21	29	59	66
35 to 44	15	22	55	64
45 to 54	14	19	49	60
55 to 64	12	17	46	55
≥ 65	16	21	48	55
Household income				
1st (lowest income)	37	44	55	63
2nd	21	28	55	63
3rd	14	21	54	63
4th	7	14	52	62
5th (highest income)	3	7	49	62
LTV group				
LTV = 80%	17	24	61	70
65% < LTV < 80%	20	26	56	65
LTV = 65%	29	31	65	72
LTV < 65%	10	15	39	49

Notes: All percentages are calculated using equal weights unless otherwise noted. LTIs are calculated by assuming that the readvanceable portion of mortgages is not drawn at origination and exclude mortgages with no income reported in the data. LTI means loan-to-income ratio; LTV means loan-to-value ratio.
Sources: Regulatory filings of federally regulated financial institutions and Bank of Canada calculations

Increase in mortgage vulnerabilities over time

Loan-to-income ratio and amortization period over time

Mortgages with high LTIs became more prevalent between 2014 and 2016 across almost all demographic characteristics and market segments (**Table 4**). Households with LTIs above 450 per cent account for 22 per cent of low-ratio mortgages in 2016, up from 16 per cent in 2014. The mortgages of these more vulnerable households are larger than the average mortgage, making up 32 per cent of the value of all low-ratio mortgages in 2016, up 9 percentage points from 2014.[15] The fact that the share of high-LTI mortgages increased to almost one-third of the low-ratio mortgage originations suggests stronger household sector vulnerabilities.

A rise in the share of mortgages with amortizations longer than 25 years, from 53 per cent in 2014 to 62 per cent in 2016, has also increased vulnerabilities for low-ratio mortgage borrowers. Among mortgages with an LTI greater than 450 per cent, the share with extended amortization rose from 79 to 86 per cent. A high LTI reduces the borrowers' ability to make

15 At origination, some households were approved for a higher loan amount potentially available as home equity lines of credit. Should these credit lines be used, the share of households with an LTI above 450 per cent could be as high as 25 per cent by count and 35 per cent by value based on 2016 originations, up from 19 per cent and 26 per cent in 2014, respectively.

prepayments, suggesting their amortization period will remain long. This pool of borrowers may therefore be more vulnerable to income shocks or unexpected increases in mortgage interest rates.

Regions with strong house price growth contributed the most to the increase in the share of high-LTI mortgages. This occurred for two reasons. First, cities in these regions have the highest price-to-income ratios and experienced the largest increases in mortgage activity, which can be partly related to fundamentals, such as strong employment growth and population gains. Second, price growth continued to outstrip income growth in these cities. In contrast, in Calgary, for example, where price growth was quite weak, the increasing share of high-LTI mortgages is mainly associated with income reductions related to the 2014 oil price decline. Similar reasons are behind the increased length of mortgage amortizations.

Focusing on age and income groups, we find that the incidence of high-LTI, low-ratio mortgages has risen for all age cohorts and income quintiles. The largest increase occurred for the under-35 age group, which contributed the most to the aggregate upward trend. Increasing vulnerabilities for younger households may be significant since, all else being equal, they may have a higher risk of being laid off during recessions, which might cause them to have difficulties repaying their mortgage (Chan, Morissette and Frenette 2011). The share of extended amortization mortgages also increased between 2014 and 2016 for all age and income groups.

Loan-to-value ratio over time

Among low-ratio mortgages, the average LTV was stable since both the 65 and the 80 per cent groups increased their shares at the expense of the group between these two (**Chart 1**). A regional differentiation shows that the share of low-LTV mortgages increased in markets with strong house price growth, with the additional equity compensating lenders for the rising share of high-LTI mortgages in these regions. However, housing market imbalances in these regions raise the concern that a house price correction could erode the additional equity.

The share of mortgages with a high LTI increased across LTV groups, except for the 65 per cent pool, where it remained stable near 30 per cent.

Conclusion

Using loan-level data from federally regulated financial institutions over the period from 2014 to 2016 allows us to assess the vulnerabilities created by high mortgage debt in Canada, across household types and over time. Low-ratio mortgages grew in importance, representing more than two-thirds of all new mortgages by 2016. At the same time, the share of these mortgages with high LTIs increased across most demographic characteristics and LTV segments, reaching 22 per cent of low-ratio mortgages overall. And the proportion of these mortgages with amortization periods extending beyond 25 years increased to 62 per cent. These trends were more pronounced among younger households and in markets with strong house price growth.

The net effect of these changes on financial system vulnerabilities cannot be summarized simply. The growing prevalence of low-ratio mortgages implies a shift of risk from mortgage insurers to lenders and also increases the amount of overall equity. At the same time, all else being equal, a greater prevalence of high LTIs and extended amortization among low-ratio mortgages suggest increased risk to the financial system in the event of a

major shock to household income. They also create vulnerabilities to higher mortgage interest rates, although many borrowers have payments that are fixed for several years.

A further subdivision of the low-ratio mortgage space reveals substantial heterogeneity in the observable vulnerabilities and characteristics of different LTVs. The group of mortgages with an LTV from 66 up to 80 per cent makes up more than half of low-ratio mortgage originations. Many of these mortgages have high LTIs and long amortization periods.

This analysis has three caveats. First, the data exclude lenders that are not federally regulated. Second, we cannot assess the riskiness of the loan portfolios of lenders because new mortgages used for purchases in any year make up only a fraction of those portfolios. Third, we do not analyze the overall underwriting or risk-management process of lenders in this report, or the amounts of capital they allocate to absorb losses should mortgage defaults occur.

Appendix

Table A-1: Proportion of mortgages by loan-to-value ratio originated in selected cities, 2014 to 2016 (per cent)

City	High-ratio mortgages	Low-ratio mortgages				
		All	LTV = 80%	65% < LTV < 80%	LTV = 65%	LTV < 65%
Toronto	11	28	26	27	42	26
Vancouver	4	11	7	9	23	13
Calgary	6	5	5	6	3	4
Halifax	1	1	1	1	1	1
Montréal	9	8	8	8	6	10
Ottawa–Gatineau	4	4	4	4	2	3
Rest of Canada	65	43	49	45	23	43

Notes: All percentages are calculated using equal weights. LTV means loan-to-value ratio.
Sources: Regulatory filings of federally regulated financial institutions and Bank of Canada calculations

Table A-2: Share of low-ratio mortgages by city, 2014 and 2016 (per cent)

City	Share of low-ratio mortgages within category	
	2014	2016
Toronto	83	87
Vancouver	85	90
Calgary	65	64
Halifax	57	55
Montréal	67	68
Ottawa–Gatineau	68	67

Note: All percentages are calculated using equal weights.
Sources: Regulatory filings of federally regulated financial institutions and Bank of Canada calculations

Table A-3: Characterizing vulnerabilities in low-ratio mortgages by city, 2014 and 2016 (per cent)

City	Share of low-ratio mortgages with LTI greater than 450 per cent		Share of low-ratio mortgages with amortization greater than 25 years	
	2014	2016	2014	2016
Toronto	25	34	69	77
Vancouver	33	38	73	79
Calgary	16	21	55	62
Halifax	6	7	38	38
Montréal	13	13	41	46
Ottawa–Gatineau	8	10	46	51

Notes: All percentages are calculated using equal weights. LTIs are calculated by assuming that the readvanceable portion of mortgages is not drawn at origination and exclude mortgages with no income reported in the data. LTI means loan-to-income ratio.
Sources: Regulatory filings of federally regulated financial institutions and Bank of Canada calculations

References

Baker, S. Forthcoming. "Debt and the Consumption Response to Household Income Shocks." *Journal of Political Economy.*

Cateau, G., T. Roberts and J. Zhou. 2015. "Indebted Households and Potential Vulnerabilities for the Canadian Financial System: A Microdata Analysis." Bank of Canada *Financial System Review* (December): 49–58.

Chan, P. C. W., R. Morissette and M. Frenette. 2011. "Workers Laid-Off During the Last Three Recessions: Who Were They, and How Did They Fare?" Statistics Canada Research Paper, Catalogue No. 11F0019M — No. 337.

Crawford, A. and U. Faruqui. 2011–12. "What Explains Trends in Household Debt in Canada?" *Bank of Canada Review* (Winter): 3–15.

Hou, F. 2010. "Homeownership over the Life Course of Canadians: Evidence from Canadian Censuses of Population." Statistics Canada Research Paper, Catalogue No. 11F0019M — No. 325.

Rea, W., D. MacKay and S. LeVasseur. 2008. "Changing Patterns in Canadian Homeownership and Shelter Costs, 2006 Census." Statistics Canada, Catalogue No. 97-554-X.

Shoring Up the Foundations for a More Resilient Banking System: The Development of Basel III

Tamara Gomes, Sheryl King and Alexandra Lai

- Following the 2007–09 global financial crisis, authorities addressed key vulnerabilities in the banking system by revamping the regulatory framework, giving rise to Basel III.
- Most of the major elements of Basel III have already been implemented and have led to substantial improvement in the banking sector's ability to withstand adverse financial conditions. In this way, it serves to enhance overall financial stability and provides a solid foundation for economic growth. At the time of writing, there are a few outstanding elements, particularly the appropriate balance between risk-weighting and minimum capital requirements.

Introduction

In the wake of the 2007–09 global financial crisis, the G20, the Financial Stability Board and the Basel Committee on Banking Supervision (BCBS) acted swiftly to revise the existing regulatory framework. The reform agenda included an overhaul of the existing global banking regulations in the Basel II framework. There were also initiatives outside the banking sector, including improving risk mitigation strategies for shadow banking activities and increasing transparency for over-the-counter derivatives.

Regulatory reform measures were designed to ensure that banks could better withstand losses and runs on funding. These measures included provisions to help end "too big to fail." The new banking regulation, known as Basel III, is close to being finalized. The reforms are strongly supported in Canada, where having a resilient banking sector helped it avoid some of the worst consequences of the financial crisis. The next phase of Basel III will be one of "dynamic implementation" as banking supervisors monitor for consistent implementation and unintended consequences.

This report highlights the core elements of Basel III. It also reviews the progress made to date in its implementation and the benefits for financial stability. Once a final agreement has been reached, authorities will focus on implementation of the outstanding aspects. They will also continue to evaluate the impact of the reforms to ensure reform objectives are achieved.

Building an International Framework: Evolution of the Basel Accord

Basel III was built on a global banking regulation framework that dates back to 1988, when the BCBS created the Basel Capital Accord, now known as Basel I (**Table 1**). Banking activities had become increasingly global in the 1970s, yet regulation remained largely local. A series of international crises (i.e., the Latin American debt crisis and the oil price shock) in the early 1980s led to poor returns on equity, which prompted increased risk taking by banks. Differing capital standards across jurisdictions encouraged the migration of risks internationally, which in turn undermined the overall soundness of the sector.

Basel I was designed to boost bank capital and ensure a consistent definition of risks and capital measurement across jurisdictions. It prescribed standard definitions of bank capital, appropriate weights corresponding to the riskiness of various asset classes (known as risk weights) and minimum levels of capital that internationally active banks should hold. It was finalized in 1988 and implemented in Canada (and other countries) in 1992. However, over the early 1990s, there was a growing realization that Basel I was too focused on credit risk and that the existing risk categories did not reflect the full spectrum of risk taking. The relatively small number of risk categories under the framework implied that assets of varying riskiness were given the same risk weights. This simple framework gave banks incentive to shift their activities toward riskier assets within each asset class. Moreover, the framework was unable to deal

Table 1: The evolution of the Basel framework

	Date finalized (implementation date)	Goals	Identified shortcomings
Basel I	1988 (1992)	Increase capital Ensure consistent definitions of risk and capital	Not sufficiently risk sensitive
Basel II	2004 (2008) Implementation not completed across all jurisdictions	Increase risk sensitivity and allow use of internal models Expand coverage of risks	Inadequate loss-absorbing capital Insufficient focus on liquidity, funding risk and interconnectedness
Basel III	Risk-based capital—2011 (2019) Liquidity Coverage Ratio—2013 (2015) Net Stable Funding Ratio—2014 (2018) Leverage ratio—2014 (2018) Revisions to calculation of risk-weighted assets—ongoing	Increase the quantity and quality of capital Enhance risk sensitivity and comparability of risk weights Restrict the buildup of leverage Ensure resilience to short-term funding stress Promote longer-term funding structures Reduce procyclicality in bank lending Address “too big to fail” Enhance risk management and disclosure	Authorities are monitoring for unintended consequences

Table 2: The three pillars of Basel III

Pillar	Objective	Description
Pillar 1: Minimum capital and liquidity requirements	Create global requirements that ensure banks have adequate capital and liquidity to withstand losses and runs on funding	Minimum requirement for capital, liquidity and leverage More stringent requirements for systemically important banks
Pillar 2: Supervisory review process	Allow supervisors to work with individual banks to assess risks not covered under Pillar 1, such as internal controls and qualitative issues	Guidelines on qualitative issues, such as corporate governance, stress testing, model validation, risk data aggregation and reporting
Pillar 3: Market discipline	Give sufficient information to markets to allow market prices to reflect and influence risk taking	Harmonized templates for public disclosure of key risk metrics to market participants

with the growing complexity and globalization of the financial system, particularly as banks developed their own model-based approaches to evaluating the risks of their balance sheets.[1]

It became clear that Basel I needed to be upgraded and, as a result, Basel II was developed. Its objective was to establish a globally consistent framework for the evaluation of risk and to ensure that the broadening set of financial activities was appropriately capitalized. To do so, it introduced three pillars (later updated for Basel III, as described in **Table 2**). Under Pillar 1, the minimum capital requirements were expanded to require banks to hold capital against operational risk and some elements of market risk in addition to credit risk, and the definition of credit risk was refined. For each risk type, banks had two options to calculate capital requirements. The standardized approach prescribed the risk weight used for each exposure, similar to Basel I. Basel II also allowed banks, under the oversight of regulators, to use their own risk models to produce risk weights, known as the internal models approach.[2] The use of supervisory-approved models was intended to provide added sensitivity to reflect differences in risks and to encourage banks to improve their own risk management.

Pillar 2 was established to allow supervisors to address risks not covered in Pillar 1 and to tailor capital requirements to individual banks. It typically covered more qualitative risk management guidelines. Finally, Pillar 3 required banks to publicly disclose key risk metrics to improve market discipline.[3]

Basel II was finalized in 2004, with full implementation expected by the end of 2008; Canada began implementation in 2006.

Identifying Lessons from the Financial Crisis: An Enhanced Framework

Despite these efforts to bolster the banking system, the global financial crisis began in 2007, before many banks and jurisdictions had even fully implemented Basel II. The failure of some fully compliant institutions showed

1 The Accord was refined over the early 1990s. The most important change broadened the requirements to include capitalization against market risks, including permitting banks to use internal models for the first time.

2 Currently, Canadian domestic systemically important banks all use internal model approaches for credit risk and market risk.

3 The Office of the Superintendent of Financial Institutions' implementation of Pillar 3 requirements under Basel II exceeded the international standard by calling for quarterly disclosures, as opposed to semi-annual.

that the framework was insufficient in several areas. These included a lack of loss-absorbing capital, little focus on liquidity and funding risk management, and too much leverage in the financial system. Moreover, banks' use of internal models to evaluate the riskiness of some of their activities gave rise to unwarranted variations across banks for similar business activities or assets. Finally, the crisis made it clear that some banks had become so important to the financial system that market participants considered them "too big to fail." This belief distorted risk management practices, increasing financial system risks.

To remedy the shortcomings of the Basel II framework identified during the crisis, the BCBS worked toward two objectives:

- reducing the likelihood that individual banks will fail when faced with adverse market conditions, and
- reducing the impact of the stress created if a bank should fail.[4]

To accomplish these two overriding objectives, the BCBS identified a number of goals, listed in **Table 1**.

In addition to strengthening individual banks, Basel III includes a macroprudential angle, which considers the health of the entire financial system.[5] Macroprudential requirements typically focus on mitigating procyclicality and contagion during financial stress and on reducing the moral hazard associated with banks considered too big to fail.

Revising the Framework: Basel III

Basel III enhances all three pillars of Basel II in important ways.

Increase the quantity and quality of capital: Banks are now required to hold an increased quality and quantity of capital. The emphasis is on common equity, which absorbs losses immediately.

Enhance sensitivity and comparability of risk weights: Basel III includes substantial changes to the risk weighting of assets. For the standardized approach, the revisions will reduce reliance on external credit ratings and increase risk sensitivity by introducing further granularity and more stringent calibration. The internal models approach will face greater constraints on its use. These constraints include both restricting the types of risk exposures that are allowed to be modelled by banks and fixing the levels of certain parameters within banks' models.

Restrict the buildup of leverage: Since risk-based capital requirements can still lead to the excessive leverage seen during the crisis, a new leverage ratio complements the other capital requirements. Since 1982, Canadian banks have been subject to a leverage constraint, expressed as a limit on banks' "asset-to-capital multiple." This leverage requirement was retained even after implementation of the risk-adjusted capital measures under Basel I and Basel II, and eventually replaced by the Basel III leverage ratio.

Ensure resilience to short-term funding stress and promote longer-term funding structures: To strengthen banks' funding and liquidity risk management, two new liquidity standards are also incorporated into the overall framework. The Liquidity Coverage Ratio (LCR) is designed to ensure that

4 A complete set of the Basel III reform measures can be found on the Bank for International Settlements website. Chouinard and Paulin (2014) review the elements of Basel III that were finalized up to 2014.

5 For more information on the differences between micro- and macroprudential regulation, see Borio (2003).

banks have enough liquid assets to withstand a short period of funding stress. The Net Stable Funding Ratio (NSFR) promotes the use of longer-term funding.[6]

Reduce procyclicality in bank lending: To mitigate procyclicality, the capital and liquidity requirements incorporate "buffers." The countercyclical capital buffer and the LCR buffer are both designed to be drawn down so that banks can maintain their critical functions during a period of stress without breaching minimum requirements.

Address "too big to fail": To reduce contagion, the framework was designed to ensure that large banks with lots of connections to the rest of the financial system—global and domestic systemically important banks (SIBs)—are especially well capitalized and hold extra liquidity. To mitigate moral hazard, SIBs must hold additional loss-absorbing capital to enable an orderly resolution.

Enhance risk management and disclosure: These revised regulatory minimums have been complemented by more emphasis on Pillar 2 requirements to enhance overall risk management and supervision. Among other items, new guidance on corporate governance, model validation and stress-testing practices are included. Finally, Pillar 3 has been improved to ensure that disclosure by banks is meaningful to users, consistent over time and comparable across institutions and jurisdictions. Sound disclosure practices allow investors to more easily compare capital and liquidity ratios across banks and over time, providing the financial system with yet another source for assessing the soundness of financial institutions.

Enhancing Bank Resilience: The Impact of Basel III to Date

The adherence of banks to the Basel III reforms has improved their resilience to financial stress. It is always possible, however, that some of the policy measures could have unintended consequences for the overall functioning of financial markets. To date, there is little evidence of serious unintended consequences of the regulations, although some participants have highlighted lower market liquidity as a possible effect (CGFS 2017). Ultimately, the reforms create a robust foundation so that banks can continue their business activities, including lending and making markets, in the face of stress, which reinforces the resilience of the overall financial system.

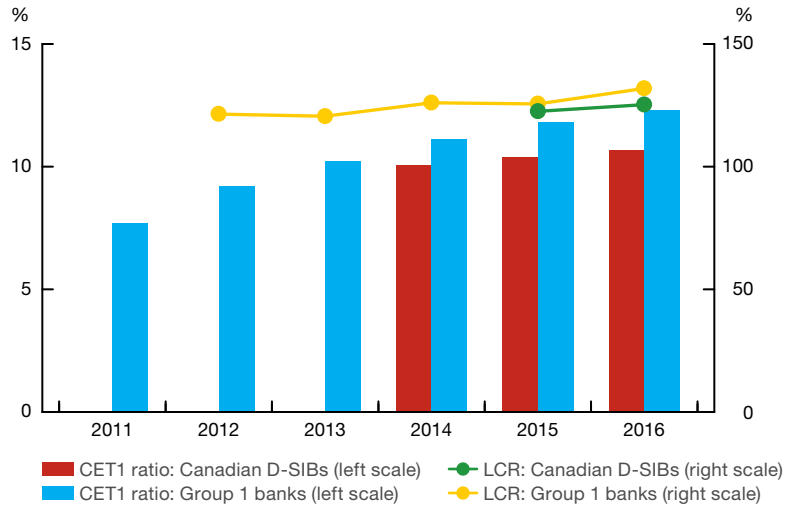
Capital and liquidity ratios have risen sharply since banks began implementing the Basel III requirements. **Chart 1** shows that the average common equity Tier 1 ratios of global banks rose from 7.7 per cent at the end of 2011 to more than 12 per cent at the end of 2016. This increase in capital has been supported by growth in retained earnings as banks returned to profitability following the crisis (BCBS 2017a). Similarly, banks' average LCRs increased from 121 per cent in 2012 to more than 130 per cent in 2016.

The increase in bank health has a stabilizing effect on the financial system and, ultimately, a positive impact on economic growth. Studies of both the global and the Canadian contexts have shown that significant benefits from having fewer financial crises accrue to the broader economy. In Canada, the net gain is estimated to be around 13 per cent of gross domestic product, or $200 billion (BCBS 2010; Bank of Canada 2010). These figures could, in

6 Gomes and Wilkins (2013) provide more detail on the development of the LCR and NSFR.

Chart 1: Basel III capital and liquidity ratios have risen sharply since 2011

Common equity Tier 1 and liquidity coverage ratios



Note: Group 1 banks are defined as internationally active banks that have Tier 1 capital of more than 3 billion euros. Canadian domestic systemically important banks (D-SIBs) are Bank of Montreal, Canadian Imperial Bank of Commerce, National Bank, Bank of Nova Scotia, Toronto Dominion and Royal Bank of Canada.

Sources: Bank for International Settlements and regulatory returns of Canadian banks

Last observation: 2016

fact, be underestimated because they assume an increase in funding costs due to implementation. Indeed, some studies have shown that adherence to heightened regulatory requirements will lower banks' funding costs.[7]

In addition to reducing the probability of future crises, strengthened bank resilience will allow banks to continue to function even during stress. Recent research finds that banks that had strong capital and liquidity levels continued to lend even during the crisis.[8] This evidence is supported by the Canadian experience during the crisis, when the stronger performance of Canadian banks relative to some of their international peers was attributed to, among other elements, better risk management and robust funding and liquidity positions (Ratnovski and Huang 2009; Arjani and Paulin 2013).

Finalizing the Framework: Work Still to Be Done

Despite these impressive gains, three core elements are still to be finalized. These elements aim to address the tension between the standardized approach and the internal models approach: under the standardized approach, risk weights are too rigid; under the internal models approach, risk weights are too variable (Rudin 2017). The first element is a revised standardized approach for credit risk that introduces a greater granularity to the Basel II approach.[9] The second includes further constraints on how internal models are used. The final element is a restriction on the benefit that using an internal model can have on the risk weightings relative to the standardized approach, known as an output floor.

7 See, for example, Ingves 2015; Galiay and Martin 2015; and Schmitz, Sigmund and Valderrama 2017.

8 See, for example, Ivashina and Scharfstein 2010; Cornett et al. 2011; and Gambacorta and Marques-Ibanez 2011.

9 The standardized approaches were finalized for market risk in 2016 and for operational risk in 2017.

Reaping the Gains: Promoting Timely and Consistent Implementation

The collective effort of international authorities has already resulted in more resilient financial institutions. However, to ensure that the gains to financial stability are fully realized, standards will need to be implemented on a timely basis across jurisdictions and consistent with the rule and spirit in which they were intended.

As of September 2017, all 27 BCBS member jurisdictions have risk-based capital rules and LCR regulations in force (BCBS 2017b). Almost all members have issued final rules for countercyclical capital buffers and frameworks for domestic SIBs.

While standards have been broadly implemented on time, there have been some delays in the adoption of those that have been finalized recently.[10] Uneven implementation could result in regulatory fragmentation and an unlevel playing field. Authorities will now focus on "dynamic implementation," monitoring the consistency of implementation, and will be attentive to the interactions between reforms and potential unintended consequences, particularly for financial market functioning and the conduct of monetary policy. Working together, the Financial Stability Board, the BCBS and other standard-setting bodies will assess whether the reforms meet the G20's overall objective of a more resilient global financial system. Authorities will consider whether revisions to the framework are warranted where strong evidence of negative impacts emerges.

Conclusion

The financial crisis revealed that global regulatory and supervisory frameworks as well as banks' own risk-management frameworks had not kept pace with the changes in bank activities and did not protect banks sufficiently during periods of extreme stress. Globally, authorities responded swiftly to address these deficiencies, promoting the resilience of the banking system.

It has been almost 10 years since the publication of the first part of the Basel III reform package aimed at shoring up the foundations of banks' risk management. Healthy banks contribute to a more resilient financial system and support robust economic growth, and banks' resilience to stress has increased significantly as implementation of Basel III has progressed. Banks and the broader financial system continue to adapt to the new environment, and authorities will continue to monitor the impacts, attentive to any unintended effects that come to light.

10 More than 75 per cent of jurisdictions have delayed implementation of the standardized approach for measuring counterparty credit risk for derivatives and capital requirements for exposures to central counterparties; the target implementation deadline was January 1, 2017. Some jurisdictions have already announced delays in implementation of the NSFR and the revised market risk framework, which were due to be implemented in 2018 and 2019, respectively.

References

Arjani, N. and G. Paulin. 2013. "Lessons from the Financial Crisis: Bank Performance and Regulatory Reform." Bank of Canada Staff Discussion Paper No. 2013-4.

Bank of Canada. 2010. "Strengthening International Capital and Liquidity Standards: A Macroeconomic Impact Assessment for Canada" (August).

Basel Committee on Banking Supervision (BCBS). 2010. "An Assessment of the Long-Term Economic Impact of Stronger Capital and Liquidity Requirements." Bank for International Settlements (August).

———. 2017a. "Basel III Monitoring Report." Bank for International Settlements (September).

———. 2017b. "Thirteenth Progress Report on Adoption of the Basel Regulatory Framework." Bank for International Settlements (October).

Borio, C. 2003. "Towards a Macroprudential Framework for Financial Supervision and Regulation?" BIS Working Paper No. 128.

Chouinard, E. and G. Paulin. 2014. "Making Banks Safer: Implementing Basel III." Bank of Canada *Financial System Review* (June): 53–59.

Committee on the Global Financial System (CGFS). 2017. "Repo Market Functioning." Bank for International Settlements, CGFS Paper No. 59.

Cornett, M. M., J. J. McNutt, P. E. Strahan and H. Tehranian. 2011. "Liquidity Risk Management and Credit Supply in the Financial Crisis." *Journal of Financial Economics* 101 (2): 297–392.

Galiay, A. and L. Martin. 2015. "Drivers of Banks' Cost of Debt and Long-Term Benefits of Regulation—An Empirical Analysis Based on EU Banks." European Central Bank Working Paper No. 1849.

Gambacorta, L. and D. Marques-Ibanez. 2011. "The Bank Lending Channel: Lessons from the Crisis." BIS Working Paper No. 345.

Gomes, T. and C. Wilkins. 2013. "The Basel III Liquidity Standards: An Update." Bank of Canada *Financial System Review* (June): 37–43.

Ingves, S. 2015. "Supporting Sustainable Growth: The Role of Safe and Stable Banking Systems." Banque de France *Financial Stability Review* 19: 65–73.

Ivashina, V. and D. Scharfstein. 2010. "Bank Lending During the Financial Crisis of 2008." *Journal of Financial Economics* 97 (3): 319–338.

Ratnovski, L. and R. Huang. 2009. "Why Are Canadian Banks More Resilient?" IMF Working Paper No. 09/152.

Rudin, J. 2017. "Waiting for Basel? Next Steps for Canada's Bank Capital Regime." Remarks to the C.D. Howe Institute, Toronto, Ontario, April 6.

Schmitz, S. W., M. Sigmund and L. Valderrama. 2017. "Bank Solvency and Funding Cost: New Data and New Results." IMF Working Paper No. 17/116.