

An Analysis of Indicators of Balance-Sheet Risks at Canadian Financial Institutions

David Xiao Chen, Data and Statistics Office; H. Evren Damar, Financial Stability Department; Hani Soubra, Financial Stability Department; and Yaz Terajima, Canadian Economic Analysis Department

- This article compares different types of Canadian financial institutions by examining over time ratios that are indicators of four balance-sheet risks—leverage, capital, asset liquidity and funding.
- The various risk indicators have decreased during the past three decades for most of the non-Big Six financial institutions in our sample and have remained relatively unchanged for the Big Six banks, resulting in increasing heterogeneity in these indicators of balance-sheet risks.
- The observed overall decline and increased heterogeneity in the risk indicators follow certain regulatory changes, such as the introduction of liquidity guidelines on funding in 1995 and the implementation of bank-specific leverage requirements in 2000. This suggests that regulatory changes have had significant and heterogeneous effects on the management of balance sheets by financial institutions and, given that these regulations required more balance-sheet risk management, they contributed to the increased resilience of the banking sector.

An important function of the Bank of Canada is to promote the safety and efficiency of the financial system in Canada. In support of this mandate, research and policy analysts at the Bank investigate the overall soundness of the Canadian banking sector, its role in the Canadian financial system and its important links with the real economy.

Recent regulatory reforms in the banking sector under Basel III¹ are aimed at promoting the resilience of banks and the overall banking system, based on the hard lessons learned from the recent financial crisis, which demonstrated that many banks in advanced economies were undercapitalized, illiquid and over-leveraged.² While Basel III pays particular attention to large, internationally active banks, financial institutions of various sizes can play different and sometimes systemic roles.³ In particular, smaller banks often fill certain niches; for example, they may have a disproportionate presence in the interbank market or in payment and settlement systems. These banks tend to have less-diversified portfolios and more-concentrated operations

¹ Basel III is a set of minimum regulatory requirements (regarding, for example, capital, liquidity and leverage) for global financial institutions. See BCBS (2011).

² While the banking sector in Canada fared better during the crisis than those in other advanced economies, the country experienced some liquidity and funding pressures.

³ See Allen and Gale (2000), Chan-Lau (2010), and Gauthier et al. (2011).

geographically.⁴ Thus, they may be more vulnerable to sector-specific or region-specific shocks than larger banks with well-diversified portfolios that are located within a broader geographic area.⁵

This article explores the similarities and differences in risks to the balance sheets of various financial institutions. We examine four important ratios—leverage, capital, asset liquidity and funding—that measure risks to bank balance sheets for two groups of financial institutions, based on their size and charter type. While many studies of Canadian financial institutions focus on the Big Six banks, this analysis provides a broader view that encompasses the entire banking sector. We also discuss how these risk indicators have evolved over the past three decades and describe relevant developments in banking sector regulation that could have contributed to the observed dynamics.

Data and Bank Groups

Our data set for Canadian financial institutions is based on financial regulatory reports, collected jointly by the Bank of Canada, the Office of the Superintendent of Financial Institutions Canada (OSFI) and the Canada Deposit Insurance Corporation.⁶ Our sample contains the regulatory financial reports of all of the 156 federally chartered deposit-taking institutions, both active and inactive.⁷

We divide our sample into two broad categories: the Big Six banks and other financial institutions (non-Big Six banks). The latter group is further subdivided in two ways: by total asset size (large, medium and small) and by charter type (foreign subsidiaries, other domestic banks, and trust and loan companies).^{8,9}

Table 1 provides summary statistics of our sample. In August 2011, the combined total assets of the Big Six banks accounted for about 90 per cent of the total assets of all of the institutions studied. The majority of non-Big Six assets are concentrated among the larger institutions.¹⁰ The Big Six banks are more diversified geographically than other institutions, as shown in the last two rows of the table: they are active in all 10 provinces and, as a group, have the lowest percentage of their total assets located in Ontario,

4 Berger et al. (2005), for example, argue that small banks tend to follow a model that involves “relationship lending,” which requires more information than simply what credit scores and financial records reveal. This model makes it easier for small banks to lend to certain types of borrowers that may otherwise find it difficult to obtain credit.

5 “Despite their small size, the Canadian Commercial Bank (CCB) and Northland Bank failures in 1985 were seen to have had the potential to adversely affect the broader Canadian banking system” (Illing and Liu 2003, 9).

6 Data since 1996 are publicly available from OSFI at <http://www.osfi-bsif.gc.ca/osfi/index_e.aspx?ArticleID=554>.

7 It excludes consolidated subsidiaries of other deposit-taking institutions in the data set (to avoid double counting) and foreign bank branches, since they are not required to hold equity. Without equity, it is not possible to calculate leverage or capital ratios. For more details on sample selection, see Chen et al. (forthcoming).

8 We divide the non-Big Six banks equally into three groups by size on a monthly basis. In August 2011, the large financial institutions were those valued at more than \$2.2 billion; the medium-sized were those valued at between \$0.2 billion and \$2.2 billion; and the small were those valued at less than \$0.2 billion.

9 Other domestic banks are Canadian banks, while foreign subsidiaries are foreign banks with a Canadian charter. Trust and loan companies have traditionally concentrated on residential mortgages and term deposits, at least until the 1990s (Freedman 1998). See Appendix 1 of this article on page 32 for a list of active financial institutions in each category in August 2011.

10 Financial institutions from each charter type are represented among the large financial institutions. See Appendix 1.

the largest province.¹¹ In contrast, the other groups of institutions are active in a smaller number of provinces and hold a higher proportion of their assets in Ontario. This is especially true for foreign subsidiaries, which are the least geographically diversified among the three charter types, despite accounting for more than half of the assets in the non-Big Six category.

Table 1: Summary statistics of the Canadian financial institutions in our sample

	Big Six banks	Non-Big Six banks					
		Large	Medium	Small	Foreign subsidiary	Other domestic bank	Trust and loan company ^a
Assets (in \$ billions), August 2011							
Total	3,076.1	284.2	16.3	1.5	165.8	73.6	62.6
Average	512.7	14.2	0.8	0.1	8.7	4.9	2.4
Number of banks, January 1983–August 2011							
Average	6.0	20.0	20.0	21.0	41.0	7.0	23.0
Geographical concentration, January 1983–August 2011							
Number of provinces in which assets are located	10.0	6.0	4.4	2.7	3.8	6.7	6.2
Percentage of assets in Ontario	20.0	33.8	41.5	38.4	41.6	24.7	32.9

a. Data on the number and geographical concentration of trust and loan companies date from 1996.

Source: Office of the Superintendent of Financial Institutions Canada

Analysis of Indicators of Balance-Sheet Risks

Four measures of risks to bank balance sheets

Our analysis focuses on four important ratios that capture different balance-sheet risks.¹²

A *leverage ratio* measures risk associated with non-capital funding of overall balance sheets. It is a simple and transparent measure of balance-sheet risk, not subject to the model and measurement errors associated with asset-risk calculations. It is defined as:

$$\text{Leverage ratio} = \frac{\text{Total assets}}{(\text{Total shareholders' equity} + \text{subordinated debt})}.$$
¹³

Other things being equal, a higher ratio is associated with greater vulnerability to adverse shocks that reduce the overall value of assets or funding liquidity.¹⁴

¹¹ The percentage of Big Six assets in Ontario (20 per cent) may appear very low, since their assets are more geographically dispersed in other provinces and in foreign countries than are those of non-Big Six institutions. In addition, some assets are not associated with a particular location (such as intangible assets), lowering the percentages of location-specific assets.

¹² A complete assessment of bank risk requires a full range of analyses (including, for example, a bank's provision for loan losses and mismatches of asset-liability maturity). In this article, however, we focus only on the four ratios that reflect the risk dimensions considered in the Basel III framework.

¹³ This definition is close to the regulatory leverage ratio used by OSFI, which is based on total regulatory capital as defined in Basel II, including subordinated debt (Bordeleau, Crawford and Graham 2009). Starting in 2013, when Canadian banks begin implementing the Basel III rules, the calculation of total regulatory capital will be slightly altered. For example, it will include deductions of defined-benefit pension funds, mortgage servicing rights and deferred tax assets.

¹⁴ Excessively high leverage could increase a bank's reliance on potentially volatile short-term sources of funding and expose it to higher funding liquidity risk (Bordeleau, Crawford and Graham 2009).

A *capital ratio* captures risks associated with bank assets. We focus on the Tier 1 capital ratio, defined as follows:

$$\text{Tier 1 capital ratio (\%)} = 100 \times \text{Adjusted net Tier 1 capital} / \text{Total risk-weighted assets.}^{15}$$

A higher capital ratio implies that a bank has relatively high capital holdings or relatively low holdings of risky assets, and is associated with less vulnerability to adverse shocks. Even if their balance sheets are the same size and they have the same amount of capital, i.e., their leverage ratios are equal, two institutions with different asset mixes can have different capital ratios.

Both the leverage ratio and the capital ratio focus on whether the bank has sufficient capital to support its assets. However, the recent financial crisis highlighted the fact that having sufficient capital alone is not a precondition for stability. Funding liquidity and asset liquidity are also important determinants of the ongoing viability of a bank.¹⁶ We therefore constructed ratios that capture the asset liquidity risk and funding liquidity risk of banks. Because of constraints on the data available for a historical analysis, these ratios are different and less complex than those proposed in the Basel III liquidity requirements.¹⁷

◀ *Having sufficient capital alone is not a precondition for stability. Funding liquidity and asset liquidity are also important determinants of the ongoing viability of a bank*

Our third measure of risk, an *asset-liquidity ratio*, is defined as follows:¹⁸

$$\text{Asset-liquidity ratio (\%)} = 100 \times (\text{Cash and cash equivalents} + \text{public securities} + \text{secured short-term loans}) / \text{Total assets.}$$

The higher the asset-liquidity ratio, the more an institution is able to withstand adverse shocks that increase the need to liquidate assets. If an institution holds less-liquid assets, its ability to withstand those shocks may be impaired.

¹⁵ Adjusted net Tier 1 capital generally includes, but is not limited to, equity and disclosed reserves, including retained earnings. Total risk-weighted assets are assets that have been adjusted to reflect their risk according to the Basel framework. Data for the Tier 1 capital ratio have been available on a quarterly basis only since 1994, after the implementation of Basel at the end of 1992. With the Basel II framework, calculation of the two components of the Tier 1 capital ratio has been modified to include consideration of market risk since 1997 and an option for financial institutions to use their own risk-assessment models (with OSFI's approval) since 2008. Under Basel III, calculation of the two components of the Tier 1 capital ratio will be modified to include a new deduction to capital (see footnote 13) and higher weighting for market-risk components in the risk-weighted assets.

¹⁶ During the crisis, liquidity in short-term funding markets dried up in the United States, the United Kingdom, the euro area and, to a much smaller degree, Canada. Consequently, banks found it difficult to fund their assets. An asset fire sale resulted as banks sold off assets they could no longer fund. With the introduction of the Basel III requirement, banks will have to report and satisfy certain levels of regulatory liquidity and funding ratios, known as the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR). The liquidity rules are aimed at measuring banks' resilience to short-term liquidity stress, with requirements set to ensure that banks have access to stable funding sources. For more details, see BCBS (2010) and Gomes and Khan (2011).

¹⁷ Our asset-liquidity and funding ratios separately capture liquidity risk on each side of the balance sheet. In comparison, the proposed liquidity standards in Basel III consider both sides of the balance sheet together and incorporate more complex assumptions on funding runoffs (e.g., sudden withdrawal of bank liabilities) and haircuts (i.e., a percentage difference between the market value of an asset and its value as collateral).

¹⁸ This ratio reflects a liquidity buffer and does not account for haircuts or interest and principal cash flows, as currently prescribed in the LCR.

Finally, we define a *funding ratio* as the proportion of a bank's total assets that are funded by wholesale funding (a relatively less stable funding source than retail (personal) deposits, for example):¹⁹

$$\text{Funding ratio (\%)} = 100 \times (\text{Non-personal deposits} + \text{repos}) / \text{Total assets.}^{20}$$

A higher funding ratio indicates that a bank relies on greater market-based funding and is therefore more exposed to adverse shocks in the market that could disrupt continuous funding of its assets.

Although these indicators are informative regarding risks to bank balance sheets, caution should be taken when using these ratios to measure relative risks across groups of institutions. High risk, as indicated by a particular ratio, may also reflect regulatory or supervisory latitude granted to an individual institution based on its strong risk-management practices. In this article, we use the terms "higher" or "lower" risk, assuming that such supervisory requirements remain constant.

Overall dynamics of the indicators of balance-sheet risks

Chart 1 shows the evolution of the four ratios that indicate balance-sheet risks for the financial institutions in our sample. Overall trends suggest that non-Big Six institutions have become more resilient over time. Capital has increased, and both leverage and funding risk have decreased. For the Big Six banks, capital ratios increased moderately until 2008, when the trend became more positive. Their leverage ratios declined in the 1980s, and then exhibited an increasing trend until 2008, when the recent financial crisis hit the Canadian economy. Asset-liquidity and funding ratios for the Big Six banks are either stable or display no long-term trend.

Several regulatory changes in the financial sector in recent decades can partly explain these movements. For example, the introduction of bank-specific regulatory limits on leverage in 2000 likely contributed to the observed widening in the dispersion of the leverage ratios for the two groups.²¹ The gradual decrease in leverage among the non-Big Six banks during the late 1990s could be the result of consolidation. After the 1992 amendments to the Bank Act, allowing cross-ownership between chartered banks and trust and loan companies, the Big Six acquired several trust and loan companies. If these institutions were highly leveraged, their acquisition and removal from the non-Big Six sample (since they became subsidiaries) may have reduced the group's overall leverage.²²

◀ *Non-Big Six financial institutions have become more resilient over time*

◀ *Several regulatory changes in the financial sector can partly explain movements in indicators of balance-sheet risks*

¹⁹ Unlike the NSFR, this definition of the funding ratio does not differentiate among the terms of funds or the risks of assets.

²⁰ Non-personal deposits (i.e., a category in the regulatory report on balance sheets) include market-based funding, such as commercial paper, bankers' acceptances and deposit notes.

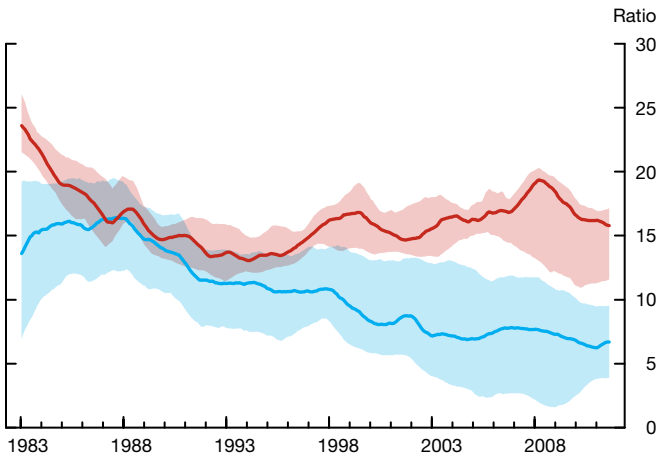
²¹ With the introduction of the regulatory leverage ratio in 1982, OSFI imposed a formal limit on banks. This limit, known as the assets-to-capital multiple (ACM) limit, has since changed over time and, in 2000, became specific to individual institutions. Smaller institutions are typically allowed to have lower limits than their larger counterparts.

²² Analysis of only the financial institutions that continued operations throughout the data period also reveals a divergent trend between the Big Six and the other institutions, although to a lesser degree, suggesting that acquisitions of non-Big Six institutions by the Big Six banks partly contributed to the observed divergence. In addition to trust and loan companies, several Canadian investment dealers (that were not included in the data set) were acquired by the Big Six banks in the late 1980s, e.g., Dominion Securities by the Royal Bank of Canada and Nesbitt Thomson by the Bank of Montreal. However, these acquisitions do not appear to have significantly increased the leverage of their parent institutions.

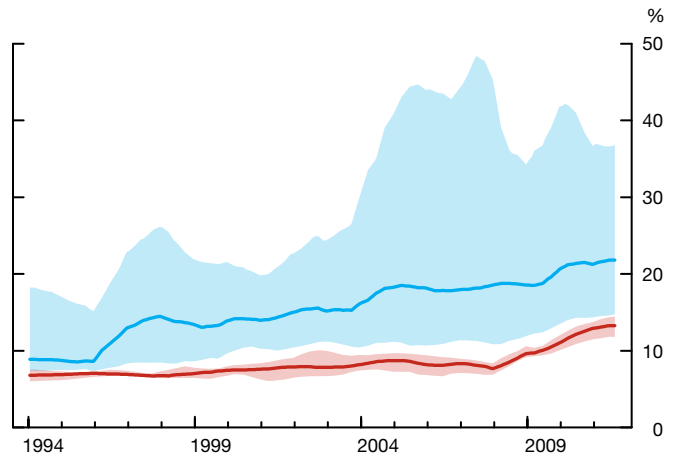
Chart 1: Indicators of balance-sheet risks at Canadian financial institutions

12-month moving average, monthly data

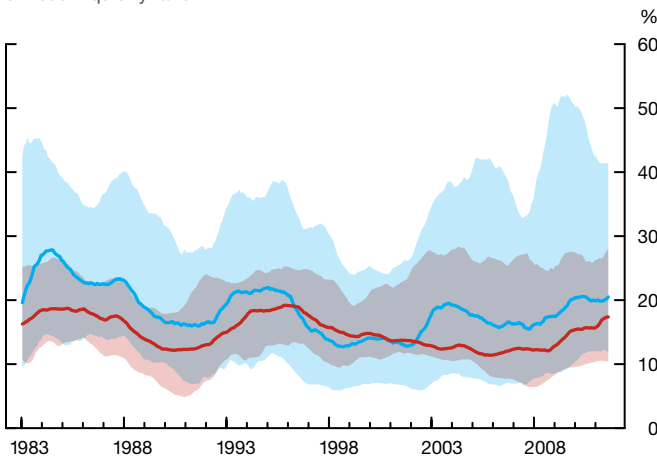
a. Leverage ratio



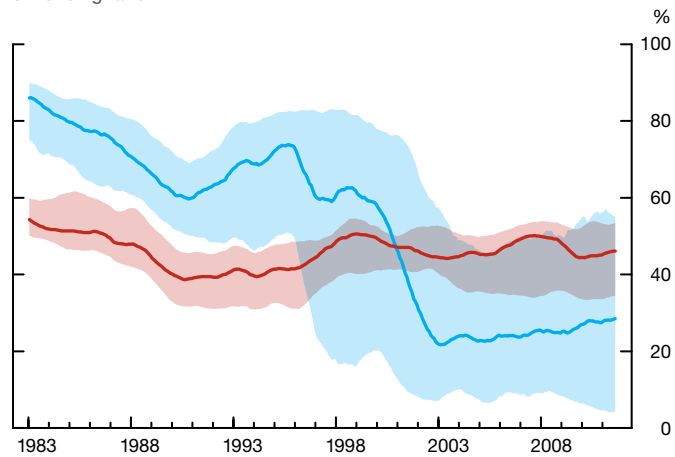
b. Capital ratio



c. Asset-liquidity ratio



d. Funding ratio



Range of Big Six banks (minimum to maximum)
Big Six banks (median)

Range of non-Big Six banks (25th to 75th percentile)
Non-Big Six banks (median)

Note: Panel d includes only institutions with wholesale funding.

Source: Office of the Superintendent of Financial Institutions Canada

Last observation: August 2011

Another notable regulatory change was the increase in the minimum capital requirement mandated by OSFI in 1999, which raised the minimum requirement for the Tier 1 capital ratio from 4 per cent (the standard specified in Basel I) to 7 per cent, contributing to the trend rise in capital. The sharp decline in the funding ratio for the non-Big Six banks in the late 1990s can be explained, in part, by the introduction of liquidity guidelines by OSFI in 1995,²³ which required institutions with high reliance on market-based funding to have strict liquidity-risk-management practices.²⁴

²³ See OSFI guidelines on liquidity at <http://www.osfi-bsif.gc.ca/osfi/index_e.aspx?DetailID=527>.

²⁴ This decline in the funding ratio is reinforced by the inclusion of trust and loan company data in 1996, which, on average, exhibit low funding ratios. In addition, dynamics regarding mergers, exits and charter changes of foreign subsidiaries (e.g., from a foreign subsidiary to a foreign branch) appear to have played some role in the decline of funding ratios around 2000. Regardless of these other factors, however, a decline in funding ratios is observed around the time of the introduction of the liquidity guidelines.

Heterogeneity of these indicators within the banking system (as measured by the differences between the Big Six and the other financial institutions, as well as by the differences among the non-Big Six institutions) has generally increased since the mid-1990s. This may be due, in part, to greater discipline imposed by markets or to regulations that have become increasingly bank-specific, implying a more appropriate alignment of these balance-sheet ratios with the underlying risks. For example, a low regulatory leverage limit for a bank imposed by OSFI may reflect an underlying risk in the bank's operations. Indeed, OSFI considers a range of factors, such as operating and management experience, strength of parent institution, earnings, diversification of assets, type of assets, and appetite for risk, when setting a regulatory leverage limit for individual institutions.²⁵ In the following section, we examine these trends by analyzing the ratios and compositions of the balance sheets of the banks in our sample, and discuss other regulatory and market developments.

Indicators of balance-sheet risks, by bank size and type

Table 2 shows the four measures of balance-sheet risks according to bank size and charter type, and by decade. Leverage ratios tend to be positively correlated with bank size. Among the non-Big Six financial institutions, domestic banks have the highest leverage, followed by foreign subsidiaries and trust and loan companies. All non-Big Six institutions show declining trends in leverage, which is consistent with the evolution shown in Chart 1a. The decline appears to be the largest for small banks, moving from 10.3 over the 1983–90 period to 1.8 after 2000, following the introduction of

◀ All non-Big Six institutions show declining trends in leverage, while the Big Six banks maintained relatively higher leverage than that of their smaller peers

Table 2: Indicators of balance-sheet risks at Canadian financial institutions, by bank size and charter type

	Big Six banks	Non-Big Six banks					
		Large	Medium	Small	Foreign subsidiary	Other domestic bank	Trust and loan company ^a
Leverage ratios							
1983–90	17.3	18.2	15.4	10.3	15.0	16.7	-
1991–2000	14.7	13.3	10.2	6.9	10.0	14.6	9.8
2001–11	16.6	11.7	8.8	1.8	8.0	9.9	4.5
Capital ratios^b (%)							
1994–2000	7.1	8.5	13.1	22.9	9.9	9.3	22.2
2001–11	9.3	11.3	17.2	58.7	15.2	12.0	30.4
Asset-liquidity ratios (%)							
1983–90	16.0	16.2	25.4	26.0	23.0	9.7	-
1991–2000	15.9	18.8	14.8	20.5	18.7	12.6	11.8
2001–11	13.4	14.6	12.6	47.0	18.5	11.3	27.8
Funding ratios (%)							
1983–90	46.9	70.6	75.1	66.1	72.5	31.2	-
1991–2000	44.3	65.5	63.7	30.3	68.9	17.3	0.4
2001–11	46.4	30.3	11.1	0.2	38.3	9.7	0.0

a. Data on trust and loan companies date from 1996.

b. Data on regulatory capital ratios date from 1994.

Note: Numbers represent an average of monthly medians in each period.

Source: Office of the Superintendent of Financial Institutions Canada

²⁵ See OSFI guidelines on capital adequacy requirements at http://www.osfi-bsif.gc.ca/osfi/index_e.aspx?DetailID=527.

bank-specific regulatory limits on leverage. In contrast, the Big Six banks maintained relatively higher leverage than that of their smaller peers throughout the sample period.²⁶

Trends for capital ratios are consistent with those for leverage ratios. Non-Big Six financial institutions have higher capital ratios, and small institutions (mostly trust and loan companies) show large increases in capital over time. This likely contributed to the observed spikes at the 75th percentile of the distribution of capital during the 2000s, as shown in **Chart 1b**. These observations point to increasing heterogeneity in capital ratios across institutions in Canada;²⁷ however, this trend is not observed everywhere (see **Box 2** for a comparison of Canada and the United States).

The composition of balance sheets of various financial institutions (**Chart 2**) helps us to understand how these trends are realized.²⁸ For many types of financial institutions, particularly small banks, capital ratios increased, owing to a rise in both capital (e.g., equity) and the percentage of assets considered to be low risk (e.g., cash, mortgage loans and public securities). Trust and loan companies are a notable exception: the decrease in the amount of lower-risk assets they held (driven mainly by a decline in mortgage loans) implies that their capital ratios increased primarily because they held more capital.

Many historical events may have influenced these observed changes to the balance sheets. For example, the loss of small banks from the sample, owing to failures in the 1980s and 1990s, may have left only less-leveraged and better-capitalized institutions in the sector.²⁹ Similarly, the acquisition of the largest trust and loan companies by the Big Six banks during the mid- to late 1990s may have resulted in the trust and loan company subgroup comprising only small and specialized institutions with riskier assets but more capital. In addition, the growing popularity of mortgage-loan securitization in the late 1990s, following the introduction of the Canada Mortgage Bonds Program, raised the percentage of mortgage loans on bank balance sheets, especially among large and medium-sized financial institutions.³⁰

High asset-liquidity ratios during the 1980s (**Chart 1c**) were driven, in part, by medium-sized banks, many of them foreign subsidiaries, as shown in **Table 2**. In contrast, the high ratios in the 2000s were driven by small banks, particularly trust and loan companies. An increase in holdings of cash and public securities (i.e., highly liquid assets) among small banks in the 2000s is evident in **Chart 2**, an observation that is consistent with increasing asset-liquidity ratios.

◀ *Trends for capital ratios are consistent with those for leverage ratios*

²⁶ The interaction of leverage dynamics and the use of market-based funding was seen as a potential amplification mechanism of adverse shocks during the financial crisis (Adrian and Shin 2010). Research at the Bank of Canada also investigates this channel using Canadian data (see **Box 1**).

²⁷ In 2008, the Basel II framework on capital requirements was implemented, allowing OSFI-approved institutions to adopt the internal ratings-based (IRB) approach to determining risk weights. In contrast to the standardized method, the IRB approach can lead to lower assessed risk weights. Since only the Big Six banks have adopted this approach, the recent divergence in capital ratios may, in part, reflect this difference in risk-assessment practices. In addition, bank-specific limits on leverage would also have contributed to increasing heterogeneity in capital ratios.

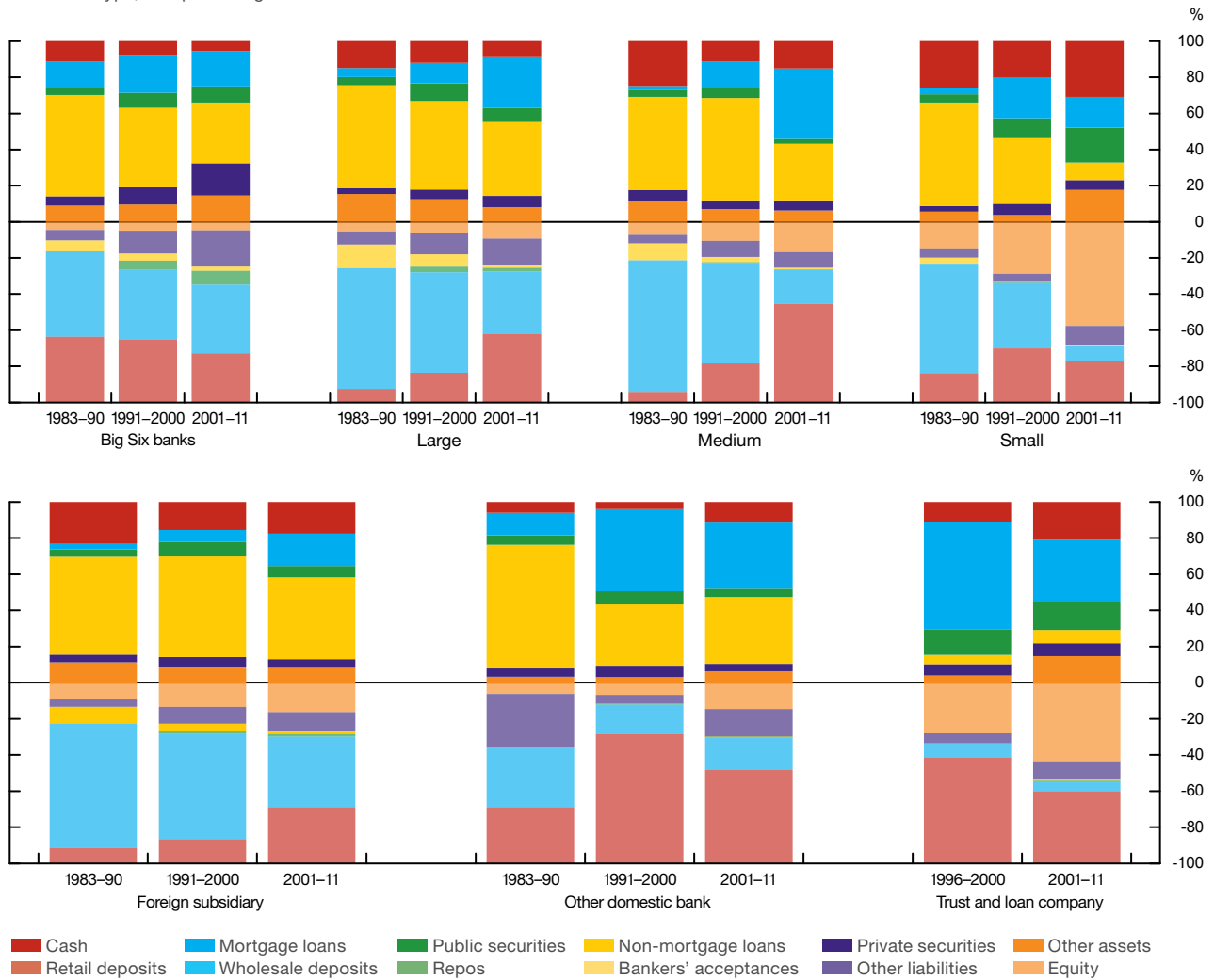
²⁸ A disaggregation of the Big Six banks reveals that their balance sheets are of a fairly similar composition, also implying their similarity in resilience to different types of shocks. Therefore, for the purposes of this article, analyses focus on the Big Six as a group.

²⁹ See Canada Deposit Insurance Corporation, "History of Member Institution Failures" at http://www.cdic.ca/e/insuredWhere/history_failures.html.

³⁰ Increasing demand for mortgage loans caused by demographic shifts and lower down-payment requirements has also played a role. See Chen et al. (forthcoming) for more details.

Chart 2: Composition of balance sheets of various financial institutions

By size and charter type, as a percentage of total assets



Note: Data on trust and loan companies date from 1996. Percentages are the averages across institutions and over time.

Source: Office of the Superintendent of Financial Institutions Canada

Last observation: August 2011

Finally, the funding ratios of the Big Six banks have remained stable since the early 1980s, moving between approximately 44 per cent and 47 per cent (Table 2), suggesting that they had in place the liquidity-management processes required by OSFI's 1995 guidelines well before the guidelines were established. Small and medium-sized banks significantly reduced their use of market-based funding over time, from more than two-thirds of their assets in the 1980s to around 10 per cent or less in the 2000s. While use of market-based funding fell dramatically across all categories of the non-Big Six group, the relatively high, continuous use of this funding source by foreign subsidiaries may have been influenced by their access to global funding markets.

◀ *The funding ratios of the Big Six banks have remained stable since the early 1980s, while small and medium-sized banks significantly reduced their use of market-based funding over time*

Box 1

Leverage and Wholesale Funding

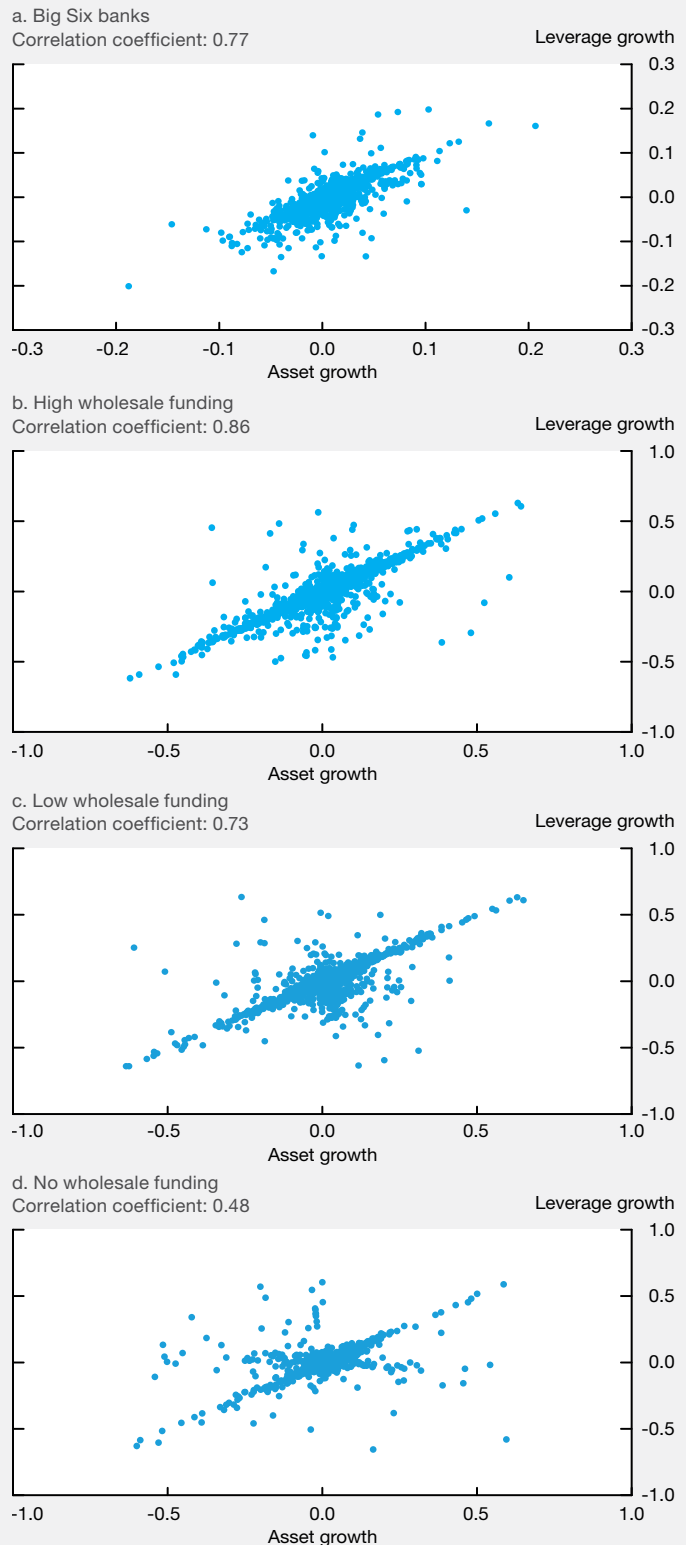
Since wholesale-funding markets are sensitive to financial and economic conditions, the degree to which a bank relies on such funding can influence its activities. Research at the Bank of Canada (Damar, Meh and Terajima 2010) examines the interaction between a bank’s reliance on wholesale funding and leverage to better understand how Canadian financial institutions manage their leverage and whether changes in leverage are positively correlated with changes in the size of their balance sheets (i.e., whether leverage is procyclical). A positive correlation between leverage and asset size implies that financial institutions use non-equity funds (i.e., debt) to finance new assets.

This phenomenon was first described by Adrian and Shin (2008; 2010; 2012), who found a strong positive correlation between leverage and balance-sheet size in U.S. investment banks. They argue that increases in the prices of certain assets (mostly securities) can increase both leverage and balance-sheet size. Since asset prices are more likely to increase during booms, bank balance sheets tend to expand, owing to a rise in marked-to-market bank asset values and higher loan demand. At the same time, perceived risk tends to fall, leading to lower interest rates for bank funding. Banks issue more debt, and thus leverage increases, thereby exhibiting procyclicality.

Using Canadian data, Damar, Meh and Terajima (2010) estimate a series of both cross-sectional and time-series regressions. They find a strong positive correlation between asset growth and leverage growth for all banks. In addition, their findings show that leverage is relatively more procyclical for institutions that rely on wholesale funding. As illustrated in **Chart 1-A**, measured correlations using monthly data decline from 0.86 for institutions with high wholesale funding to 0.73 for those with low wholesale funding, and finally to 0.48 for those with none.¹ The correlation for the Big Six banks is 0.77, which does not stand out among other banks. The degree of correlation between asset growth and leverage growth is therefore closely related to the funding source and is present among more financial institutions than just the largest Canadian banks.

Damar, Meh and Terajima (2010) conclude that, since wholesale funding is cheaper and can be obtained more readily than retail deposits, a bank with access to wholesale-funding markets can easily purchase new assets with these funds, leading to procyclicality in leverage. Their analysis also establishes that highly liquid wholesale-funding markets make it even easier for Canadian banks to purchase assets using wholesale funds, strengthening the positive correlation between assets and leverage.

Chart 1-A: Monthly change in assets and leverage in Canada, 1994–2009



¹ Qualitatively similar results are observed using annual data. The correlation measures for the Big Six, as well as non-Big Six institutions with high, low and no wholesale funding are 0.37, 0.66, 0.54 and 0.47, respectively.

Source: Office of the Superintendent of Financial Institutions Canada

Box 2

A Comparison of Bank Capital Ratios in Canada and the United States

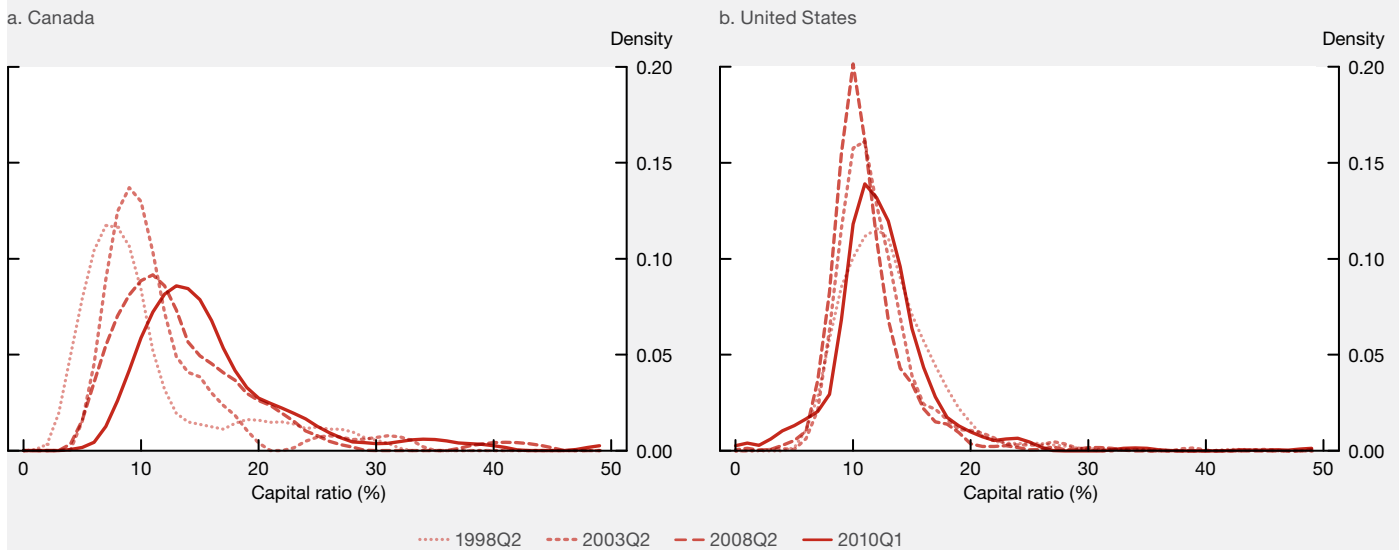
Capital ratios among Canadian banks have become more heterogeneous over time; however, this trend has not been observed in the United States.

Chart 2-A shows the estimated probability density (i.e., kernel density estimations) of capital ratios of financial institutions in Canada and the United States. In Canada, an increasing mode and fatter right tail (i.e., the number of financial institutions with higher capital ratios) have been observed over time, while in the United States, the

distribution has remained relatively unchanged and is centred around its mode.¹ As noted, the increasing amounts of higher capital holdings (and hence fatter right tails) have been driven primarily by the non-Big Six Canadian financial institutions. The country's bank-specific regulatory approach contributes, in part, to this heterogeneity.

¹ Chart 1b in the main text shows that the distributional shift to higher capital ratios in Canada is also slightly supported by the Big Six banks, suggesting the systemic importance of these changes.

Chart 2-A: Estimated probability density of capital ratios, Canada and the United States



Sources: Office of the Superintendent of Financial Institutions Canada and the Federal Reserve Bank of Chicago

Last observation: 2010Q1

Concluding Remarks

This article analyzes the balance-sheet ratios of Canadian financial institutions. Overall, various measures of risk have decreased over the past three decades for most non-Big Six institutions and have remained relatively unchanged for the Big Six banks. We find that smaller institutions, particularly trust and loan companies, generally have lower leverage and higher capital ratios than other types of financial institutions, including the Big Six banks. They also have larger holdings of liquid assets and face lower funding risk compared with other financial institutions. The observed overall decline and increased heterogeneity in risk (as measured by divergent trends in the leverage, capital and asset-liquidity ratios) followed certain regulatory changes, such as the introduction of liquidity guidelines on funding in 1995 (which preceded a sharp decline in, and more dispersion of, funding ratios among non-Big Six institutions) and the implementation of bank-specific leverage requirements in 2000 (which preceded a divergence in leverage ratios between the Big Six and non-Big Six institutions). This suggests that regulatory changes had significant and heterogeneous impacts on the management of balance sheets by financial institutions, resulting in

the increased resilience of the banking system. While market discipline may have also played a role, more research is needed to identify changes in the degree of market discipline in the Canadian banking sector.

Given the observed variation in behaviour among Canadian financial institutions, continued analysis of different types of institutions can enable a more comprehensive assessment of financial stability. Understanding the different risks faced by various types of financial institutions improves the framework that the Bank of Canada uses to monitor developments of potential risks in the banking sector.

Appendix 1

Table A-1: Active financial institutions, by bank size and charter type, in August 2011

Big Six banks			
Bank of Montreal	Canadian Imperial Bank of Commerce	Royal Bank of Canada	
Bank of Nova Scotia (The)	National Bank of Canada	Toronto-Dominion Bank (The)	
Non-Big Six banks			
	Foreign subsidiary	Other domestic bank	Trust and loan company
Large	AMEX Bank of Canada Bank of Tokyo-Mitsubishi UJF (Canada) BNP Paribas (Canada) Citibank Canada HSBC Bank Canada ICICI Bank Canada ING Bank of Canada MBNA Canada Bank	Bridgewater Bank Canadian Tire Bank Canadian Western Bank Laurentian Bank of Canada Manulife Bank of Canada	AGF Trust Company Equitable Trust Company (The) Home Trust Company MCAN Mortgage Corporation Peoples Trust Company RBC Dexia Investor Services Trust ResMor Trust Company
Medium	Bank of China (Canada) Industrial and Commercial Bank of China (Canada) Korea Exchange Bank of Canada Mega International Commercial Bank (Canada) Shinhan Bank Canada Société Générale (Canada) State Bank of India (Canada) Sumitomo Mitsui Banking Corporation of Canada UBS Bank (Canada)	Bank West First Nations Bank of Canada General Bank of Canada HomeEquity Bank Pacific & Western Bank of Canada President's Choice Financial	Community Trust Company Effort Trust Company (The) League Savings and Mortgage Company M.R.S. Trust Company Peace Hills Trust Company
Small	CTC Bank of Canada Habib Canadian Bank	Alterna Bank Citizens Bank of Canada DirectCash Bank Jameson Bank	BNY Trust Company of Canada Caledon Trust Company Computershare Trust Company of Canada Concentra Trust Equity Financial Trust Company Fiduciary Trust Canada First Data Loan Company, Canada Industrial Alliance Trust Inc. Investors Group Trust Co. Ltd. Legacy Private Trust Oak Trust Standard Life Trust Company State Street Trust Company Canada Valiant Trust Company

Literature Cited

- Adrian, T. and H. S. Shin. 2008. "Financial Intermediaries, Financial Stability, and Monetary Policy." Federal Reserve Bank of New York Staff Report No. 346.
- . 2010. "Liquidity and Leverage." *Journal of Financial Intermediation* 19 (3): 418–37.
- . 2012. "Procyclical Leverage and Value-at-Risk." Federal Reserve Bank of New York Staff Report No. 338.
- Allen, F. and D. Gale. 2000. "Financial Contagion." *Journal of Political Economy* 108 (1): 1–33.
- Basel Committee on Banking Supervision (BCBS). 2010. "Basel III: International Framework for Liquidity Risk Measurement, Standards and Monitoring." Available at <<http://www.bis.org/publ/bcbs188.pdf>>.
- . 2011. "Basel III: A Global Regulatory Framework for More Resilient Banks and Banking Systems." Available at <<http://www.bis.org/publ/bcbs189.pdf>>.
- Berger, A. N., N. H. Miller, M. A. Petersen, R. G. Rajan and J. C. Stein. 2005. "Does Function Follow Organizational Form? Evidence from the Lending Practices of Large and Small Banks." *Journal of Financial Economics* 76 (2): 237–69.
- Bordeleau, E., A. Crawford and C. Graham. 2009. "Regulatory Constraints on Bank Leverage: Issues and Lessons from the Canadian Experience." Bank of Canada Discussion Paper No. 2009-15.
- Chan-Lau, J. A. 2010. "Balance Sheet Network Analysis of Too-Connected-to-Fail Risk in Global and Domestic Banking Systems." International Monetary Fund Working Paper No. WP/10/107.
- Chen, D., H. E. Damar, H. Soubra and Y. Terajima. "Canadian Bank Balance-Sheet Management: Breakdown by Types of Canadian Financial Institutions." Bank of Canada Discussion Paper (forthcoming).
- Damar, H. E., C. Meh and Y. Terajima. 2010. "Leverage, Balance Sheet Size and Wholesale Funding." Bank of Canada Working Paper No. 2010-39.
- Freedman, C. 1998. "The Canadian Banking System." Bank of Canada Technical Report No. 81.
- Gauthier, C., T. Gravelle, X. Liu and M. Souissi. 2011. "What Matters in Determining Capital Surcharges for Systemically Important Financial Institutions?" Bank of Canada Discussion Paper No. 2011-9.
- Gomes, T. and N. Khan. 2011. "Strengthening Bank Management of Liquidity Risk: The Basel III Liquidity Standards." Bank of Canada *Financial System Review* (December): 35–42.
- Illing, M. and Y. Liu. 2003. "An Index of Financial Stress for Canada." Bank of Canada Working Paper No. 2003-14.