Annex 1: Lending-Spread and Growth in Lending Analysis

Annex 1.1

Lending spreads and growth in lending

This annex summarizes several alternative analyses conducted by Bank of Canada staff to estimate the impact on Canadian banks' lending spreads and the growth of lending from implementing the proposed capital and liquidity reforms. Selected output from this exercise can be used as an input to the Bank of Canada's macroeconomic models to evaluate the short- and long-run impact of the proposed reforms on Canadian economic growth.

Following the approach of both the MAG and LEI reports, analysis of the impact on lending spreads can be conducted using either a "regression-based" approach (using an error-correction model) or an "accounting-based" approach. The regression-based approach also facilitates analysis of the impact of the proposed reforms on lending growth.[1] We have adopted several variants of these two fundamental approaches to assess the impact of the reforms on the Canadian banking system. Table 1 summarizes the estimated long-run impact on Canadian banks' lending spreads based on a representative scenario where banks increase their Tier 1 capital ratio by 2 percentage points. Four alternative analyses are highlighted in Table 1, each of which is discussed in more detail in the following sections. Taking these results together, a 2-percentage-point rise in banks' Tier 1 capital ratio is estimated to raise lending spreads in Canada by between 17 and 34 basis points. These results are based on a number of underlying assumptions, which are discussed in the following sections.

Table 1: Long-run impact on Canadian lending spreads assuming a 2-percentage-point increase in banks' Tier 1 capital ratio*

Methodology used	Long-run impact on lending spreads
Regression-based approach (i.e., error-correction model)	28 bps
Bank of Canada accounting-based approach - Average 2001–06 data - End–2006 data	 21 bps 31 bps
Baseline scenario from LEI report (average 1993–2007 data; accounting-based approach)	17 bps
Bank of England variant of accounting-based approach	34 bps

[1] See section 1.3 of this annex for details of the analysis of the impact on lending growth.

* In basis points. Results exclude the impact of liquidity reforms.

It should be mentioned that results reported in the remainder of this annex pertaining to the impact of the proposed liquidity reforms on both lending spreads and growth in lending should be viewed as preliminary and subject to change. This is due to a number of factors, including data limitations, which prevent a formal modelling of the Liquidity Coverage Ratio in any of the analyses conducted, although an analysis is presented showing the impact on lending spreads if major Canadian banks sought to meet the new Liquidity Coverage Ratio by converting their holdings of residential mortgages into federal-government-guaranteed National Housing Act (NHA) mortgage-backed securities. Further limitations in the data required a number of assumptions when modelling the proposed Net Stable Funding Ratio (NSFR). Little weight is attached to this part of the analysis, however, since the Basel Committee on Banking Supervision (BCBS) has decided to delay implementation of the NSFR pending further modification to the original proposal, which was released in December 2009. The BCBS anticipates the release of a revised proposal for the NSFR by the end of 2010, but it will initially operate on an observation phase to allow time for experience to be gained with it before it is finalized and becomes an official standard.[2]

[2] See accompanying annex to BCBS press release, "The Group of Governors and Heads of Supervision reach broad agreement on Basel Committee capital and liquidity reform package" (26 July 2010).

Annex 1.2

Estimating the impact of higher capital requirements on loan spreads: Application of LEI "accounting-based" approach to the Canadian banking system[3]

Introduction

One objective of the Long-term Economic Impact (LEI) report is to quantify the impact of the proposed capital and liquidity reforms on banks' capital structure, their weighted average cost of capital, and ultimately on the cost of borrowing for consumers and businesses. As its name suggests, the focus of the LEI study is on the difference between the pre-reform and post-reform long-run steady states.

This note outlines in greater detail the analysis of the LEI study in assessing the economic cost of the proposed regulatory reforms, and how the results for the Canadian banking system compare with those of other countries.

LEI data, methodology, and results

A core tool of the LEI study in evaluating the cost of the reforms is a comprehensive spreadsheet analysis that draws on historical balance-sheet and income statement data for over 6,600 banks from 13 national banking systems, including Canada. Bank-level data for each country were collected from the Bankscope database and appropriately averaged to arrive at a single "representative" bank for each jurisdiction. Tables 1 and 2 summarize the pre-reform steady-state (simplified) balance-sheet and other regulatory and performance data of the representative Canadian bank, and compare this information with the 13-country average. The LEI group agreed to use average balance-sheet and income statement data for the period 1993–2007 as a suitable representation of the pre-reform steady state.

Table 1: Pre-reform steady-state balance-sheet and other data, Canada and others, 1993–2007*

Assets	CAN	13-C[4]	Liabilities	CAN	13-C
Cash and balances at central banks	0.8	2.3	Deposits by customers (retail,	60.6	43.5
Interbank claims	12.1	12.2	corporate)		
Trading-related assets	18.6	10.4	Interbank funding	8.4	12.6
Net loans, leases, and mortgages	51.4	51.6	Trading-related liabilities	16.3	15.2
Investments and securities	9.4	16.1	Wholesale/subordinated debt	2.4	14.2
Other assets	7.6	7.4	Other liabilities	7.9	9.3
Of which: Goodwill and intangibles	0.5	0.5	**TOTAL LIABILITIES**	**95.6**	**94.8**
TOTAL ASSETS	**100.0**	**100.0**			
			Minority interests	0.1	0.2
			Preferred shares	0.5	0.3
			Other reserves and equity**	-0.5	0.1
			Common equity	4.2	4.7
			TOTAL LIABILITIES AND SHAREHOLDER'S EQUITY	**100.0**	**100.0**

* As a percentage of total assets. Numbers may not sum exactly to 100 due to rounding.

[3] For more details, see the final report of the LEI group.

[4] This refers to the 13 countries included in the study.

** From Canadian banks' regulatory returns data, this deduction is often in the form of a "foreign currency translation adjustment."

Table 2: Pre-reform steady-state regulatory and performance indicators assumed by the LEI group, Canada, and others, 1993–2007

	CAN	13-C		CAN	13-C
Regulatory:			**Performance:**		
Risk-weighted assets/total assets	48.5%	53.9%	Return on shareholder equity	10.1%	14.8%
Tier 1 capital ratio	7.7%	9.1%			

To assess the impact of the proposed regulations, the LEI group used its spreadsheet analysis to determine (i) the impact on lending spreads from incremental increases in the Tier 1 capital ratio and (ii) the impact on lending spreads of banks achieving a NSFR equal to one in the post-reform steady state. The LEI group does not consider implementation of the Liquidity Coverage Ratio, owing to lack of available data. Below, we describe the methodology and results for both of these assessments.

The impact on lending spreads from incremental increases in the Tier 1 capital adequacy ratio

Beginning with the pre-reform steady-state scenario for each country, the group assumes that the Tier 1 ratio of banks is increased in increments of 1 percentage point. Holding the size of the balance sheet constant, the necessary rise in common equity to meet the new regulatory requirement is offset by a decline in wholesale funding. It is assumed that, initially, long-term wholesale funding is reduced since this is the more costly form of financing. If a bank's liabilities must be reduced further after all long-term wholesale funding has been exhausted, then a deduction is made from short-term wholesale funding.

> **Note:** Without available bank-level data for each jurisdiction, the LEI group maintains a blanket assumption that 25 per cent of wholesale debt funding is short-term in nature, meaning less than one year to maturity, while the remainder is long-term. Moreover, the cost of banks' short- and long-term liability financing has been calibrated according to the interest expense reported in the 1993–2007 income statement. More specifically, short-term wholesale funding is assumed to cost 100 basis points more than deposit financing on an annual basis, while long-term wholesale funding is assumed to cost 200 basis points more than the annual deposit rate. Banks' cost of equity is assumed to equal the historical 15-year return on equity (ROE), calculated between 1993 and 2007. It deserves mention that these costs are not assumed to change between the pre-reform and post-reform steady state.[5]

The increase in common equity held by banks and the reduction in interest expense as a result of the required deleveraging have a negative and positive impact on banks' ROE, respectively. However, the former impact is typically much larger, such that the required rise in the Tier 1 ratio causes banks' ROE to fall. A core assumption underlying the analysis of the LEI group is that the pre-reform steady-state ROE is maintained in the new steady state. Thus, banks must find some means of increasing net income

[5] Based on Table 1, Canadian banks rely far less (more) on wholesale funding (deposits) than do their international counterparts. While this may be true in practice, the amounts in Table 1 are slightly overstated. This is because the Bankscope data, which are based on regulatory return data, do not differentiate between deposit notes and other marketable debt securities issued by banks, and wholesale deposits held at banks, during the data-collection period. This does not apply to subordinated debt issuance, which represents most, and perhaps all, of the amount listed in Table 1 under debt financing for Canadian banks.

to raise their ROE back to the pre-reform level. A further assumption is that banks fully pass this obligation onto borrowers in the form of increased lending spreads on loans to consumers and businesses.

To illustrate the above mechanics, Table 3 shows the income statement for the representative Canadian banks in the pre- and post-reform steady states following a 2-percentage-point rise in the Tier 1 capital ratio.[6] It shows that, were Canadian banks required to raise their Tier 1 ratio, holding all other factors constant, lending spreads on loans to businesses and consumers will increase by 17 basis points based on the LEI analysis. This is the amount required to increase both loan interest income and, ultimately, net income to achieve an ROE of 10.1 per cent, which is assumed to have existed in the former steady state according to the LEI group's report. Recall that 51.4 per cent of Canadian banks' total assets are in the form of lending to businesses and consumers in the two steady states.

Table 3: Pre- and post-reform steady-state income statement for Canadian banks*

	Pre-reform	Post-reform
Interest income on loans	2.2%	2.3%
Interest income ex loans	1.8%	1.8%
Interest Income	4.0%	4.1%
Interest expense	2.5%	2.5%
Net interest income	1.5%	1.6%
Trading income	0.0%	0.0%
Non-interest income excluding trading income	1.9%	1.9%
REVENUE	3.4%	3.5%
Operating expenses	2.8%	2.8%
Pre-tax income	0.6%	0.7%
Net income	0.4%	0.5%
Shareholder equity	4.3%	5.3%
Return on equity (ROE)	**10.1%**	**10.1%**
Change in lending spreads		**17 bps**

* As a percentage of total assets

The rise of 17 basis points in Canada, estimated in the LEI analysis for a 2-percentage-point increase in capital, is lower than the 13-country average of 31 basis points. It should be noted that there was significant variation among countries for this exercise, with a range of 10 basis points to 76 basis points. Although several of the assumptions made by the LEI group have contributed to this variation across countries, differences in the historical ROE that each country is assumed to maintain in both the pre- and post-reform steady states is the core assumption driving the result.[7]

The impact on lending spreads of banks having to achieve a NSFR equal to one

[6] Recall that this does not require a 2-percentage-point rise in common equity, since risk-weighted assets add up to roughly 50 per cent of total assets held by Canadian banks.

[7] Indeed, as subsection 1.3 of this annex indicates, the major Canadian banks' ROE since 2000 has been roughly 18 per cent, well above the 10 per cent figure assumed by the LEI group.

The LEI group makes a considerable effort to evaluate the impact of the proposed liquidity reforms on banks' lending spreads, focusing on the requirement to maintain a post-reform NSFR equal to 1. Given the lack of available data in a variety of areas, including the stability of banks' deposits, the credit quality of banks' securities, and the precise maturity of their wholesale funding instruments, a number of assumptions were necessary. It should be noted that supervisors in some countries were able to provide rough estimates of these amounts for their jurisdictions, and the LEI group used these figures to form views on the appropriate assumptions for all countries in the study.[8]

The precise formula for calculating the NSFR for the purpose of the LEI's analysis is detailed in the December 2009 BCBS consultative document. The LEI group considers a simplified version of this formula, illustrated in terms of Canadian banks' pre- and post-reform NSFR in Table 4. As mentioned in the introductory section, in July 2010 the BCBS announced that the NSFR proposal presented in December 2009 is currently undergoing a number of revisions, with a modified NSFR proposal anticipated by the end of 2010. Therefore, these results should be viewed as preliminary and subject to change.

Table 4: Pre- and post-reform steady-state income statement for Canadian banks*

	Pre-reform	Post-reform	BCBS factor

[8] More specifically, the assumptions applied to all countries are as follows: 75 per cent of deposits are stable; 25 per cent of securities are less than one year in maturity; 25 per cent of corporate loans are less than one year in maturity; 25 per cent of retail loans are less than one year in maturity; 25 per cent of debt is less than one year in maturity; and 25 per cent of investments and securities are held in the form of government debt.

Available stable funding (ASF)			
Tier 1 and Tier 2 capital instruments	4.3%	5.3%	100%
Wholesale funding and liabilities >1 year	7.8%	9.4%	100%
Stable deposits <1 year (as % of total deposits)	45.5%	45.5%	85%
Less stable deposits (as % of total deposits)	15.2%	15.2%	70%
All other liabilities and equity not included above	23.0%	19.5%	0%
A. Total ASF (numerator)	**0.61**	**0.64**	
Required stable funding (RSF)			
Cash and short-term, unsecured, liquid instruments	0.8%	0.8%	0%
Securities <1 year	2.3%	5.0%	0%
Loans to financials <1 year (e.g., interbank)	8.4%	8.4%	0%
Debt issued by sovereign and quasi-sovereigns	1.8%	15.0%	5%
Loans to corporate clients <1year	12.9%	12.9%	50%
Loans to retail clients <1 year	12.9%	12.9%	85%
All other assets	61.0%	45.1%	100%
Undrawn amount of committed credit and liquidity facilities	3.0%	3.0%	10%
Other contingent obligations	3.0%	3.0%	10-%
B. Total RSF (denominator)	**0.79**	**0.64**	
C. NSFR ratio (A/B) — must be greater than 1.0	**0.78**	**1.00**	

* As a percentage of total assets

Following directly from the LEI group's explanation of the NSFR, the numerator measures the sources of available stable funding (ASF), with greater weight given to funding sources that are more stable and least likely to disappear under stressed market conditions. Equity, longer-term debt, and longer-term liabilities are the most stable forms of funding, followed by deposits. The denominator shows assets that require funding, with a factor (or haircut) applied based on their expected liquidation value under stressed circumstances. Cash, securities with less than one year to maturity, and interbank loans do not have to be funded and have a factor of 0 per cent. Government debt is considered very liquid and must only be funded at 5 per cent of face value. Corporate loans and retail loans that mature within one year must be funded at 50 per cent and 85 per cent, respectively, assuming that they are not rolled over when they mature. All remaining assets must be funded at 100 per cent.

As shown in Table 4, Canadian banks maintain a pre-reform steady-state NSFR of 0.78, which is slightly below the 13-country average of 0.83. The range across the 13 countries is between 0.68 and 0.97. To bring the NSFR up to a value of 1, banks are assumed to take one or more of the following actions, with the exact strategy for each country differing, given their unique starting conditions: replace short-term wholesale funding with long-term wholesale funding; restructure the securities portfolio towards higher-quality government securities; and, if necessary, substitute more "investments and securities" in place of "other assets." It deserves mention that a higher proportion of equity to debt has the natural benefit of boosting the NSFR.

The changes mentioned above to meet the new NSFR requirement are expected to have a detrimental impact on banks' post-reform ROE. For instance, substitution of long-term debt for short-term debt will drive up interest expenses. The LEI assumes a 100-basis-point difference between the cost of short-term funding and the cost of long-term funding. At the same time, a shift into high-quality government securities and out of more risky securities will reduce banks' operating income, where the LEI group assumes that this opportunity cost amounts to 100 basis points per year.

Bringing together all of these assumptions, the LEI group estimates that the change in lending spreads necessary for banks to meet the NSFR requirement is about 29 basis points, on average, across the 13 countries. For the major Canadian banks, the impact is 51 basis points. Recall that this impact across countries is broadly consistent with the change in lending spreads that is necessary following a 2-percentage-point change in the Tier 1 capital ratio.

It should be noted that, in a supplementary analysis, the LEI group also allows for a reduction in banks' risk-weighted assets that is expected to follow from a shift into higher-quality government securities in order to meet the NSFR requirement. In this alternative scenario, the impact on lending spreads as a result of the proposed liquidity reforms across the 13 countries is nearly cut in half, to around 16 basis points or roughly the equivalent of a 1-percentage-point change in the Tier 1 capital ratio. Moreover, the aforementioned revisions to the NSFR proposal to be released later this year, coupled with the treatment of residential mortgages in the application of the proposed liquidity reforms, are likely to moderate this impact even more.

Some supplementary comments on the LEI analysis

As discussed above, out of necessity, the LEI analysis uses a number of assumptions. Several of these are likely to contribute to a relatively conservative result, in that the reported increase in spreads is likely to be on the high side. In particular:

- Banks are assumed to pass on the full cost of the capital and liquidity reforms to businesses and consumers in the form of higher loan costs. Alternatively, banks could find other methods of raising their post-reform ROE, including increasing non-interest income, or perhaps finding ways to lower their operating expenses.

- The decline in bank leverage and the reduced riskiness of banks in the new environment might also reduce the cost of both equity and debt for banks. The LEI baseline scenario reported above does not allow for any of these effects.

Annex 1.3

Estimating the impact of higher capital requirements on lending volumes and loan spreads: Application of MAG satellite models to the Canadian banking system

Introduction

This note summarizes the results of employing alternative satellite models utilized by the Macroeconomic Assessment Group (MAG) to estimate both the short- and long-run impact of the proposed reforms. We use these models to examine the impact of the reforms on the growth of the balance sheets of the major Canadian banks, and also the lending spreads that they charge to businesses and consumers. The projected post-reform path of lending volumes and spreads generated by this exercise can then be used as inputs to the Bank of Canada's large-scale macroeconomic models to arrive at a view on the impact that the reforms are expected to have on the path of Canadian economic growth over a specified period of time.

In the first section, we calculate the effect of a change in capital requirements on the growth of balance sheets of Canadian banks. We follow the methodology of Francis and Osborne (2009), who estimate a long-run risk-weighted capital ratio for British banks and calculate the effects of deviations of actual risk-weighted capital ratios on asset growth and capital-stock growth. We find that deviations from trend of aggregate risk-weighted capital ratios, the result perhaps of a regulatory change that increases capital requirements, have only a small effect on the growth of lending by Canadian banks.

In the second section, we discuss findings on the impact of changes in banks' capital requirements on lending spreads charged to customers. In Annex 2.2 of the MAG's interim report, the "satellite models sub-group," which was coordinated by the UK FSA, proposes two alternative modelling approaches to estimate the impact of the anticipated capital and liquidity reforms on banks' lending spreads: a "regression-based" approach and an "accounting-based" approach. Given sufficient data availability, we summarize our application of both of these approaches to the Canadian banking system, under the hypothetical scenario that Canadian banks are required to increase their Tier 1 capital ratio by 2 percentage points. Unfortunately, analysis of the impact of the proposed liquidity reforms using the regression-based approach does not lead to reliable results, as will be discussed.

1. Estimating the effects of capital requirements on lending volumes in Canada

1.a. Calculating target capital levels and capital gaps

Francis and Osborne (2009) model banks' target capital ratio, k_t^* , as determined by various time-varying characteristics, $X_{n,t}$, such that

$$k_t^* =. \ \kappa \ + \sum_{n=1}^{N} \theta_n X_{n,t} \quad , \tag{1.1}$$

and assume that the change in the actual capital ratio k_t is a function of the gap between the target and actual capital ratio (hereafter the "capital gap") in the previous period:

$$k_t - k_{t-1} = \lambda\,(k^*_{t-1} - k_{t-1}) + \epsilon_t\,. \tag{1.2}$$

Some substitution gives us our primary estimation equation for the target capital ratio:

$$k_t - (1-\lambda)k_{t-1} = \lambda\left(\kappa + \sum_{n=1}^{N}\theta_n X_{n,t-1}\right) + \epsilon_t\,. \tag{1.3}$$

In practice, we regress our capital ratio on one of its own lags and two lags of our time-varying characteristics, such that

$$k_t = a_0 + a_1 k_{t-1} + \sum_{n=1}^{N}\sum_{j=1}^{2} b_{n,j} X_{n,t-j} + \epsilon_t \tag{1.4}$$

with the long-run effects, θ_n , being calculated as:

$$\theta_n = \frac{\sum_{j=1}^{2} b_{n,j}}{1-a_1}\,. \tag{1.5}$$

Consistent with Francis and Osborne (2009), the proxy for the actual capital ratio that we use to estimate the equation above is the ratio of total regulatory capital over risk-weighted assets ($rwcr$). The indicators included in our set, $X_{n,t}$, are the following:

- The ratio of provisions to on-balance-sheet assets, proxying internal estimates of risk ($provisions$)
- The ratio of risk-weighted assets to total assets, which can be thought of as a regulatory measure of risk ($risk$)
- Annualized return on equity (roe), proxying the cost of capital
- The ratio of subordinated term debt to total liabilities ($subdebt$), to control for exposure to market discipline
- The ratio of Tier 1 capital to total capital ($tier1$), proxying for the quality of capital
- The ratio of trading book assets to total balance sheet assets ($trade$)

Our data set is quarterly from 1994Q2 through 2010Q1. Note that the following estimation results are not directly comparable with Francis and Osborne's, in that ours use aggregate data. All of the indicators listed above were available at the bank level to Francis and Osborne, who estimate the long-run relationship of the target capital ratio to $X_{n,t}$ for a "typical" British bank, using dynamic panel methods allowing for bank-specific fixed effects. In our case, not all of the indicators were obtainable at the bank level for Canada in the time frame allotted for the current exercise. Hence, we use aggregate data, with the indicators and capital ratios used (as well as the asset and capital growth rates studied below) being weighted averages of those for the major Canadian banks.

The following equations (1.6) and (1.7) give the long-run relationship between our indicators and the target capital ratio, $rwcr^*$, and in turn to $rwcr$ itself (*t*-stats provided in parentheses):

$$rwcr_t^* = \underset{(0.348)}{\mathbf{7.16}}provisions_t + \underset{(0.0002)}{\mathbf{0.336}}risk_t - \underset{(0.323)}{\mathbf{0.0006}}roe_t + \underset{(0.113)}{\mathbf{4.46}}subdebt_t + \underset{(0.350)}{\mathbf{0.121}}tier1_t - \underset{(0.102)}{\mathbf{0.292}}trade_t \quad (1.6)$$

$$rwcr_t = \underset{(0.093)}{\mathbf{0.730}}rwcr_{t-1} + (1 - \mathbf{0.730})rwcr_t^* \quad (1.7)$$

Of these, the most significant is *risk* (not surprising, perhaps, since riskier banks tend to be less well capitalized). This is in contrast to Francis and Osborne, who obtain the same negative sign but with a much lower level of significance. Of the other indicators, *subdebt* is the most significant. The low adjustment parameter of around 0.73 gives shocks to the deviation of the capital-asset ratio from target $Z = k - k^*$ a half life of only two quarters or so; an augmented Dickey-Fuller test on the estimated capital gap rejected a unit root at the 5 per cent level (*p*-value 0.026), providing confidence that our aggregate capital gap is stationary. Clearly, the capital-asset ratio of the Canadian banking system returns to trend quite quickly.

1.b. Estimating the effects of bank capitalization on balance-sheet and lending growth

Having determined the series of deviations of the capital-asset ratio from banks' target capital ratio that was estimated in the above section—these deviations are denoted as $Z = k - k^*$—we can add it to a regression of the growth of the balance-sheet components of the major Canadian banks as a lagged error-correction term. Specifically, we estimate

$$\begin{Bmatrix}\Delta A_t \\ \Delta C_t\end{Bmatrix} = \alpha + \beta Z_{t-1} + \varepsilon_t, \quad (1.8)$$

where A is the log of a component of bank assets (however measured) and C the log of bank capital levels. We add several control variables such as GDP, inflation, and the policy interest rate, but do not find any such indicators of the economic cycle significant across equations, and adding them does not significantly affect the final results. Neither does adding own lags of assets or capital to the regressions.

Table 1.2 shows the impact of the deviation of the capital-asset ratio from target on growth rates of

1. Total loans held by major Canadian banks
2. Their total balance-sheet assets
3. Their risk-weighted assets
4. The total regulatory capital holdings of the banks
5. Their holdings of high-quality Tier 1 capital

Table 1.2: Effects of lagged Z on growth of balance-sheet components

	β

Growth rate of:	Mean	*t*-stat.
Total loans	0.148	0.387
Total assets	-0.033	0.076
Risk-weighted assets	-0.279	0.647
Total regulatory capital	-1.066	-2.994
Tier 1 capital	-0.594	1.922

Somewhat surprisingly, we do not find a significant positive impact of Z on assets (and only for total loans do we obtain a positive sign). The effect of Z on capital levels, on the other hand, does have the right (negative) sign, and the effect is highly significant. Recall that Z represents the deviation of banks' capital ratio from the estimated target which was derived above.

Possibly, the puzzling results for assets are a result of the use of aggregate data, but given the sound status of Canadian banks, it may be that Canadian banks have held a sufficient buffer above current capital requirements that an increase in regulatory requirements, which greatly increased the target capital-asset ratio, would not compel them to reduce lending appreciably. There would, however, presumably be a rapid and substantial adjustment of capitalization.

1.c. Simulations of changes in regulatory capital requirements

Table 1.3 details the estimated impact on total lending volume (measured by the total loans on the books of the major Canadian banks) of a regulatory change that increases the target capital ratio by 2 percentage points; one scenario has the increase occurring over two years (0.25 per cent rise in target each quarter for eight quarters), and another has the increase take place over four years (0.125 per cent rise in target for 16 quarters). In both scenarios, the response of lending volume is quite small even at horizons four or eight years out, no more than 1 per cent or so; this is well in the low end of the tail of the responses in the MAG interim report. As deviations of the capital-asset ratio from target are not very persistent (with a half-life of only two quarters or so), more than 90 per cent of the effect of an exogenous rise in target capital ratios is realized in the first two years and the difference between the response four and eight years out is negligible.

Table 1.3: Deviations of lending volumes (in per cent) from baseline forecasts

	Canada		MAG cross-country results	
	4-year impact	**8-year impact**	**4-year impact**	**8-year impact**
Capital target increases 2 per cent...				
... over two years	-1.0	-1.0	Median: -2.7 Min: -1.3 Max: -7.2	Median: -3.8 Min: -1.5 Max: -7.2
... over four years	-1.1	-1.1	Median: -2.6 Min: -1.1 Max: -7.1	Median: -3.8 Min: -1.5 Max: -7.2

2. Estimating the effects of capital requirements on lending spreads in Canada

As noted above, the satellite models subgroup of the MAG proposed two approaches to estimate the impact of the anticipated capital and liquidity reforms on banks' lending spreads; in this section, we

apply both of these approaches to the Canadian banking sector to assess the impact of a hypothetical 2-percentage-point increase in banks' existing Tier 1 capital ratio over some fixed period of time (discussed below).

2.a. Regression-based approach

The regression-based approach follows largely in the spirit of the UK FSA approach outlined in Barrell et al. (2009), who utilize an error-correction model that is warranted by statistical evidence of a long-run-equilibrium relationship between bank lending spreads and a variety of policy- and risk-related variables, including banks' risk-adjusted capital ratio.[9]

The premise behind this type of modelling approach is that, over the long run, there exists a stable (or, equilibrium) relationship between two or more variables. From time to time, shocks have the potential to push this relationship away from its equilibrium. However, these deviations are assumed only to be temporary, and the dependent variable will "adjust" over subsequent periods to restore the equilibrium relationship. It follows that a core coefficient estimated by this model is the speed of adjustment back to long-run equilibrium. Other characterizations of these models might also allow the possibility of other "short-term" factors affecting the change in the dependent variable from one period to the next, in addition to the deviation from long-run equilibrium occurring in past periods.

To begin, we assume that banks' lending spreads are a function of both risk and regulatory factors. Following Barrell et al. (2009), our characterization of this relationship is as follows:

$$lendw = f(cap_{rat}, nwpi, con_{bankr}, head, invhead, liqr), \quad (2.1)$$

where

$lendw$: A measure of the household lending spread. We calculate this as the difference between the posted 5-year conventional mortgage rate administered by Canadian chartered banks and the yield on the benchmark 5-year Government of Canada bond.[10] (Source: Statistics Canada)

cap_rat: Risk-adjusted capital-adequacy ratio of the banking sector. We produce an aggregate Tier 1 capital-adequacy ratio for the major Canadian banks, based on Office of the Superintendent of Financial Institutions (OSFI) regulatory returns data. A higher capital requirement might constrain banks' ability to provide new loans, causing spreads on loans to rise. Moreover, one way for banks to raise additional capital is through increased retained earnings, which is a direct function of the profit margin that banks earn when providing loans to customers. (Source: OSFI)

[9] See R. Barrell, E. Davis, T. Fic, D. Holland, S. Kirby, and I. Liadze. "Optimal Regulation of Bank Capital and Liquidity: How to Calibrate New International Standards." FSA Occasional Paper Series, No. 38. July 2009.

[10] During sensitivity testing, not reported in this annex, we also follow Allen and McVanel (2009) and further deduct the swap spread from the mortgage rate. This is the spread over the 5-year Government of Canada bond yield that banks must pay to swap 5-year fixed-term funding back to floating-rate funds. Results are largely the same with and without this adjustment.

$nwpi$: The ratio of net worth to personal income. Our metric is based on Statistics Canada's measure of personal net worth as a percentage of personal disposable income. Barrell et al. propose this as a proxy for consumer risk, and anticipate that the sign on the coefficient in the estimated equation will be negative. We argue that this need not be the case, since much of the literature on financial crises shows that a significant buildup in asset prices often precedes episodes of banking system stress. Thus, we leave open the possibility that the sign on this coefficient could be positive or negative. (Source: Statistics Canada)

con_bankr: The consumer bankruptcy rate. This is measured as the proportion of the Canadian population aged 20 and over who declared bankruptcy during the period in question. This is another measure of consumer risk; however, it differs from the risk measure proposed by Barrell et al., who instead use data on mortgage loans in arrears. We view the data on arrears and bankruptcy as being quite different in nature. The former is more forward-looking with respect to banking system stress, while bankruptcy data may be a contemporaneous or lagging indicator of banking sector losses. (Source: OSFI)

$head$: Barrell et al. define a variable called "headroom," which is the actual capital ratio of banks less the required target (regulatory) ratio. The view is that banks maintain some level of precautionary capital, and where this buffer moves below the "normal" preferred buffer of a bank, it may choose to increase its lending margin in an effort to move back towards its target capital ratio. We build this variable by subtracting the OSFI minimum required Tier 1 capital-adequacy ratio from the aggregate Tier 1 capital-adequacy ratio of the major Canadian banks, based on OSFI regulatory returns data.[11] (Source: OSFI)

$invhead$: The inverse of the *head* variable. Barrell et al. acknowledge that, as headroom goes to zero, one might expect significant non-linear increases in borrowing costs. This variable is included to possibly capture this effect. (Source: OSFI)

$liqr$: The ratio of liquid assets to total assets. This is a rather crude proxy variable intended to capture the impact of the proposed liquidity reforms on lending spreads. It is assumed that, in an effort to meet the new Net Stable Funding Ratio (NSFR) requirement, banks may take action by shifting into higher-quality securities holdings as a means of reducing the denominator of this ratio. The net effect of this action may be that lending spreads rise, given that banks' ability to lend will become more constrained if they have to hold more liquid assets in the form of low-yield securities. Liquid assets are generally defined as cash, notes, gold, deposits held at other banks, short-term loans to other financial institutions, and government-issued securities. (Source: OSFI)

[11] Note that the minimum required Tier 1 capital-adequacy ratio was changed from 4 per cent to 7 per cent for Canadian banks at the end of 1999.

Data have been collected at a quarterly frequency for the period 1994Q2 to 2010Q1. A lack of regulatory data at this frequency earlier than 1994Q2 prohibits our use of a longer data set. Summary statistics of each of the above variables are provided in Table 2.1.

Table 2.1: Summary statistics of data used in spread regressions

	Mean	Median	Maximum	Minimum	Std. Dev.
$lendw$	2.37	2.36	5.06	1.3	0.703
con_bankr	34.85	34.68	45.96	26	3.93
$head$	2.81	2.87	4.78	0.990	0.744
$invhead$	39.1	34.82	101.05	20.92	14.58
cap_rat	8.73	8.95	11.78	6.65	1.47
$liqr$	0.141	0.136	0.210	0.107	0.0262
$nwpi$	5.77	5.71	6.57	4.97	0.430

A first step is to test each of these variables for a unit root to help in mitigating the chance of spurious results. Observation of the time-series plots of these data (not shown) suggests that many of these variables are non-stationary. Augmented Dickey-Fuller test statistics, reported in Table 2.2, suggest that, among our variables, only the consumer bankruptcy variable is evidently stationary.

Table 2.2: Results of Augmented Dickey-Fuller tests on risk and regulatory factors

Variable	*t*-stat
con_bankr	-4.24**
$head$	-1.77
$invhead$	-2.86*
$lendw$	-2.13
cap_rat	0.250
$liqr$	-1.63
$nwpi$	-1.90

*Significant at 10% level. **Significant at 1% level.

The lack of evidence that our dependent variable *lendw* is stationary is perhaps unexpected, since over the long run we would expect the difference between the 5-year mortgage rate and the 5-year GoC bond yield to be I(0). Certainly, these series move together very closely based on our knowledge of them. However, in our small sample, a plot of the two components of the spread shows them slowly diverging over time. Earlier work on the Canadian mortgage market by Allen and McVanel (2009) shows that the discounts on posted mortgage rates "... have increased from approximately 25 basis points in

the early 1990s to around 125 basis points at the end of our sample." Unfortunately, a precise time series of this discount is unavailable, necessitating our reliance on the posted rate.

Performing a unit-root test on the differences of the non-stationary-level data reveals that the underlying series are I(1). Given that both our dependent variable and several of our independent variables are I(1), using a standard least-squares-regression approach could produce spurious results. There is still a possibility, however, of using an error-correction framework similar to that of Barrell et al. if we find evidence that these series are cointegrated or, in other words, that there is a meaningful long-run statistical relationship between them.

The next step, then, is to explore several alternative specifications of our proposed relationship between spreads and the numerous control variables. We are fairly generous with our use of lags at first, and we subsequently pare down our regression over several iterations to arrive at the following stable relationship (related *t*-statistics are provided in parentheses):

$$lendw_t = \underset{(-4.31)}{-\mathbf{3.635}} - \underset{(-2.53)}{\mathbf{0.0465}} con\_bankr_{t-4} + \underset{(4.11)}{\mathbf{0.140}} cap\_rat_t + \underset{(4.43)}{\mathbf{1.101}} nwpi_{t-2} . \qquad (2.2)$$

Among the core observations from the above equation is that a one-unit (i.e., percentage-point) increase in Canadian banks' Tier 1 ratio is estimated to increase lending spreads by approximately 14 basis points; hence a 2-percentage-point increase would boost lending spreads by 28 basis points. Moreover, consistent with the literature on financial crises, we find a positive relationship between the ratio of personal wealth to personal disposable income and lending spreads, with a lag of two quarters. Perhaps a surprising result is the sign of the coefficient on the consumer bankruptcy variable, which is consistently found to be significant with a lag of four periods across our various specifications. This relationship warrants further exploration and understanding.

As was the experience for several other members of the MAG satellite group, our results are limited to assessing the impact of the proposed capital reforms on lending spreads, while the impact of the proposed liquidity reforms is still uncertain. An alternative specification of the regression-based approach suggests that a 1-point change in the percentage of liquid assets to total assets for Canadian banks will have a long-run impact on lending spreads of approximately 4 basis points. However, strong statistical evidence that such a relationship exists between these variables is lacking. A lack of precision in modelling the impact of the proposed liquidity reforms using the regression-based approach, coupled with these statistically insignificant results, constrains our ability to appropriately assess the impact of the liquidity reforms on Canadian economic activity. Thus, the remainder of the discussion in this section pertains only to implementation of the capital reforms.

To test whether the relationship in equation (2.2) is cointegrated, we apply a unit-root test to the residuals generated by this estimation. In this case, the Augmented Dickey-Fuller test rejects the null hypothesis of the residuals containing a unit root, suggesting that there is a long-run equilibrium relationship between our chosen variables.

One way to estimate the error-correction model is to use the estimated residuals of the above equation, lagged one period, as the right-hand-side variable in the error-correction specification, and then

estimate it with a second least-squares regression.[12] This produces the following result (*t*-statistics in parentheses):

$$\Delta lendw_t = \underset{(0.64)}{\mathbf{0.0277}} - \underset{(-3.20)}{\mathbf{0.484}}(e_{t-1}^{hat}) \; . \qquad (2.3)$$

Examination of equation (2.3) shows that the speed of adjustment coefficient is of the expected sign (negative), so that a positive departure from equilibrium in the previous period will be corrected by a negative amount in the current period, and vice versa. The value of this coefficient suggests a fairly quick adjustment back to long-run equilibrium following a shock.

Combining equations (2.2) and (2.3), our final estimated error-correction specification is as follows:

$$\Delta lendw_t = -\mathbf{0.484}[lendw_{t-1} - (-\mathbf{3.635} - \mathbf{0.0465}con\_bankr_{t-4} + \mathbf{0.140}cap_{rat\,t} + \mathbf{1.101}nwpi_{t-2})]. \quad (2.4)$$

We use these results to generate a path for lending spreads leading up to the long-term result reported in equation (2.2), where it is anticipated that a 2-percentage-point rise in the Tier 1 capital ratio will lead to a rise in lending spreads of roughly 28 bps, holding all other factors constant (i.e., 2 pp x 14 bps). Table 2.3 shows the results from this work, where it is assumed that the 2-percentage-point increase in the Tier 1 ratio is implemented gradually over both a 2-year and 4-year period. The table shows the impact on lending spreads after 17 quarters and after 32 quarters for each of the implementation periods. In addition, cross-country results reported in the MAG report are also shown in Table 2.3.

Table 2.3: Estimated deviations of lending spreads from baseline forecasts

	Canada		**MAG cross-country results**	
	4-year impact	**8-year impact**	**4-year impact**	**8-year impact**
Capital target increases 2 per cent...				
... over 2 years	28 bps	28 bps	Median: 35 bps Max: 50 bps Min: 10 bps	Median: 31 bps Max: 51 bps Min: 10 bps
... over 4 years	26 bps	28 bps	Median: 30 bps Max: 53 bps Min: 9 bps	Median: 32 bps Max: 55 bps Min: 10 bps

It deserves mention that a similar analysis was conducted to estimate the impact on corporate lending spreads from a 1-percentage-point change in the Tier 1 capital requirement. However, we found no statistical evidence of a relationship between corporate borrowing spreads (which, owing to a lack of

[12] An introduction to error-correction models can be found in most undergraduate texts, for example, R. C. Hill, W. Griffiths, and G. Judge. 2001. *Undergraduate Econometrics*. 2nd Ed. John Wiley & Sons.

data, had to be proxied using a corporate bond spread variable) and changes in banks' Tier 1 capital requirement. This is, perhaps, not a surprising result, given (i) the lack of available data on corporate lending spreads charged by the Canadian banks, and (ii) that chartered banks account for only one quarter of total business lending in Canada, with the majority of business financing conducted through the capital markets. In contrast, chartered banks' share of household lending in Canada is close to 60 per cent (excluding debt that has been securitized through both government-administered and private programs), which suggests that the household lending spread used in the above analysis may serve as a suitable proxy for overall lending spreads in Canada.

2.b. Accounting-based approach

For countries that do not have ready access to historical time-series data for the banking sector, the MAG proposes as an option a more straightforward accounting-based approach. Similar to the LEI group's approach, which was discussed in the previous subsection of this annex, the MAG's proposed analysis is intended to calculate the change in lending spreads necessary for banks to retain the same ROE following implementation of the proposed reforms. We follow this approach and conduct further work using our own variation of the accounting-based approach, focusing on the impact of the proposed capital reforms (for reasons cited earlier, we leave out analysis of the liquidity reforms). This will, at the very least, serve as a useful cross-check to the earlier-reported results of the LEI group, as well as the results of the regression-based approach outlined above.

As demonstrated in the previous subsection, this type of analysis is typically based on a "snapshot" of banks' balance sheets and income statements (recall the "pre-reform steady-state" representation in the LEI group's analysis), where bank size is held constant and a substitution of equity for debt is assumed to take place for banks to meet the increased regulatory capital requirement. To come to a view on the impact on lending spreads, the analysis involves working backwards through the post-reform income statement all the way up to the top line, and calculating the required change in interest income necessary to raise the post-reform ROE to its pre-reform level. The required increase in interest income is usually spread over banks' share of assets that are loans to produce the average change in lending spreads on customer loans. Although typically it is assumed that the rate of return on assets and the costs of equity and debt are unchanged between the pre- and post-reform period, the analysis does not preclude an adjustment of debt funding costs in the post-reform state, for instance taking account of banks being less leveraged.

As mentioned, building our own accounting-based approach as part of the MAG exercise serves as a useful cross-check against the Canadian results stemming from the LEI group's study. Given the data that are available for the Canadian banking system (which are not available for all countries covered in the LEI study), we can use this as an opportunity to test the sensitivity of the LEI group's results to, for example, alternative pre-reform "starting points" for the analysis and also increased granularity with respect to the composition of Canadian banks' liability structure and their overall cost of capital. An illustration of this increased granularity is provided in Table 2.4, which shows the pre-reform balance sheet of the Canadian banking system using average data between 2001 and 2006 as a starting point. The end–2006 balance sheet of the Canadian banks is also considered as an alternative starting point. Recall that the starting point used by the LEI was based on average data between 1993 and 2007.

Full details of the analysis are not shown; however, the reader can refer to the previous section for information on how the study is undertaken, since the exercise closely followed the overall methodology of the LEI group.[13] Table 2.5 provides the high-level results of the analysis, showing that,

[13] The Excel spreadsheet used to generate these results can be made available upon request.

based on alternative pre-reform starting conditions, a 2-percentage-point increase in Canadian banks' Tier 1 capital ratio is estimated to increase loan spreads by between 12 and 31 basis points.

There are, perhaps, two core messages that emerge from this exercise. First, the methodology and results of the LEI group appear to be fairly robust to various forms of sensitivity testing. In this case, we looked at two alternative starting points to that of the LEI group, and added greater granularity to the underlying analysis for Canadian banks; yet the impact on lending spreads from an increase in the Tier 1 capital ratio appears to be similar to that of the LEI (recall that this impact was 17 basis points for Canadian banks). Second, the results generated in this exercise support our finding with the LEI work that a positive correlation exists between the starting ROE for the banking sector and the overall impact on lending spreads following the regulatory change.

Table 2.4: Pre-reform balance sheet of major Canadian banks, 2001–06*

Assets		Liabilities	
Cash and balances at central banks	0.5	Deposits and notice deposits (retail,	12.5
Deposits with banks + interbank loans	4.3	government)	
Securities	26.7	Fixed-term deposits (retail, government)	15.5
- *Of which: trading*	*16.5*	Interbank deposits	7.8
- *Of which: investment*	*8.2*	Cheques and other items in transit	0.1
Net loans, leases, and mortgages	54.5	Bankers' acceptances	2.4
Bankers' acceptances	2.4	Obligations from borrowed securities	4.8
Land, buildings, and equipment	0.6	Obligations from assets sold under	7.4
Derivatives-related amounts	7.6	repurchase agreements	
Other assets	4.2	Derivatives-related amounts	7.7
- *Of which: Goodwill and intangibles*	*1.0*	Wholesale funding (incl. bus. deposits)	30.3
		Subordinated debt outstanding	1.5
TOTAL ASSETS	**100.0**	Non-controlling interest in subsidiaries	0.4
		Other liabilities	4.8
		TOTAL LIABILITIES	95.2
		Common shares outstanding	1.3
		Retained earnings	3.0
		Contributed surplus	0.0
		Preferred shares outstanding	0.5
		Other reserves and equity	0.0
		TOTAL LIABILITIES AND SHAREHOLDER'S EQUITY	**100.0**

* As a percentage of total assets. Numbers may not sum exactly to 100 as a result of rounding. Wholesale funding figures include business deposits, due to data constraints during this period (data are from OSFI).

Table 2.5: Estimated impact on lending spreads from 2-percentage-point change in Tier 1 ratio (Bank of Canada accounting-based approach)

Pre-reform starting point	Starting ROE	Impact on lending spreads
Average 2001–06	18%	21 bps
End–2006	21%	31 bps

Annex 1.4

Estimating the impact of higher capital and liquidity requirements on loan spreads: Application of Bank of England's accounting-based approach to the Canadian banking system

Capital requirements

This section summarizes the findings of an additional analysis conducted by Bank of Canada staff to assess the potential impact of higher capital standards on the customer lending spreads charged by the Canadian banks. The analysis follows an accounting-based approach described by the Bank of England in its June 2010 *Financial Stability Report*.[14] Table 1 illustrates this methodology, based on a scenario where the major Canadian banks increase their Tier 1 capital ratio by 2 percentage points. Figures used in the analysis are based on the six major Canadian banks' fiscal year-end 2009.

Table 1: Impact on Canadian lending spread from a 2-percentage-point increase in banks' capital ratio

(All figures in millions, unless otherwise specified)	
Total assets	**2,606,946**
Tier 1 capital (A)	**115,677**
Risk-weighted assets (B)	**999,525**
Regulatory capital ratio (A/B)	**11.6%**
Equity needed for 2% increase in capital ratio (C = 0.02*B)	**19,991**
Hypothetical assumptions:	
- Cost of equity (D)	**18%**
- Wholesale debt cost (E)	**5%**
- Marginal tax rate (F)	**32%**
Cost of raising additional equity: (G = C*D)	**3,598**
Savings from retiring debt of equal amount: (H = E(1-F)*C)	**680**
Net effect in terms of funding costs to recoup (I = G-H)	**2,918**
Required change in before-tax net income (J = I/(1-F))	**4,292**
<u>Estimate of pre-reform average lending rate</u>	
Net interest income on loans (proxy for "spread") (K)	**110,069**
Total value of loans to businesses and households (L)	**1,286,680**
Average interest "spread" per dollar in lending (M = K/L)[15]	**8.55%**

[14] See Bank of England. *Financial Stability Report*. June 2010. The approach is highlighted in *Box 7: The long-term economic impact of higher capital levels*.

[15] At first glance, the initial average interest spread looks very high relative to current interest rates. That is because data on interest income included both interest revenues on loans plus investment income. This is not important for the analysis, because what matters is the change in interest spreads arising from the implementation of the new rules, not the level of the spread.

Estimate of post-reform average lending rate	
Net interest income on loans – post-reform (N = K+J)	**114,361**
Post-reform average interest "spread" per dollar in lending (O = N/L)	**8.89%**
Difference between pre- and post-reform average interest spread (O-M)	**~ 34 bps**

From Table 1, total assets of the Canadian banking sector are about $2.6 trillion, where close to half of this amount ($1.2 trillion) consists of loans to consumers and businesses. Risk-weighted assets are equal to $999.5 billion.

If banks raise their Tier 1 capital ratio by 2 percentage points, this would require an increase in Tier 1 capital held of about $20 billion which, if remunerated at 18 per cent,[16] would represent a cost of around $3.6 billion for the banks. However, it is assumed that, holding the size of the bank balance sheet constant, they can retire $20 billion in debt to offset the rise in equity. Assuming the typical cost of wholesale debt to be around 5 per cent annually, and that banks' marginal tax rate is equal to 32 per cent,[17] this would result in an after-tax saving to the bank of approximately $680 million. Thus, the net cost to the banks of having to raise capital by 2 percentage points is just over $1.4 billion.

The analysis assumes further that banks choose to fully recover this higher funding cost by raising interest charges on loans to businesses and households. In this case, the Canadian banks must generate an additional $4.3 billion in pre-tax loan interest income, which can be recovered by increasing the average spread charged on loans by about 34 basis points.

Using residential mortgages to meet the new Liquidity Coverage Ratio

While the international reports faced some significant challenges in computing the impact of the new Liquidity Coverage Ratio liquidity standard on lending spreads, in Canada one can obtain a rough indication of the cost of the new standard by examining the cost for the major Canadian banks of converting their holdings of residential mortgages into NHA-insured mortgage-backed securities (MBS). These are securities that are guaranteed by the federal government, and thus would be eligible liquid assets under the new liquidity rules. Banks can convert their residential mortgages into NHA-MBS by paying the Canada Mortgage and Housing Corporation (CMHC) an insurance premium for mortgages that have not already been insured by CMHC, and then paying CMHC a fee to convert them into NHA-MBS.

Table 6 applies the Bank of England accounting framework used above to estimate in broad terms the cost in terms of lending spreads that the major Canadian banks would face to convert their mortgages into NHA-MBS.[18] The analysis is similar to that shown in Table 5 for capital requirements. Using conservative assumptions regarding the cost of insuring mortgages and converting them into NHA-MBS, it shows that the cost of converting existing insured high-ratio mortgages would be about 9 basis points, while the cost for conventional mortgages would be about 22 basis points owing to the need to insure the latter mortgages before converting them into NHA-MBS. In the case of the latter, one should also take into account the reduced capital charges for banks that would arise from insuring conventional

[16] This reflects the major Canadian banks' average ROE between 2001 and 2006.

[17] This is the figure used by the LEI group for Canadian banks, based on Bankscope data between 1993 and 2007.

[18] The analysis focuses on the six major Canadian banks, because most smaller banks are in a better position to meet the new liquidity standards without having to convert their mortgage assets into NHA-MBS.

mortgages with CMHC, since insured mortgages do not attract capital charges in bank capital rules, whereas uninsured conventional mortgages are subject to capital requirements that are about 50 per cent of those assigned to regular loans. Since uninsured conventional mortgages represent about 8 per cent of total assets, this would reduce the cost of capital in lending spread terms by about 5 basis points. Taking all of these factors into account, and considering that banks hold roughly equal amounts of insured and uninsured mortgages, the impact on lending spreads of the major banks converting their total holdings of residential mortgages into NHA-MBS would be about 14 basis points, i.e., roughly the equivalent of a 1-percentage-point change in bank capital requirements.

It should be borne in mind that the ability of the major banks to fully satisfy the new Liquidity Coverage Ratio will vary from bank to bank, depending on their business models and the extent to which they focus on lending to households versus other banking activities, such as business lending or capital markets activities. Moreover, banks may have other ways of satisfying the new liquidity rules at a cheaper cost than by simply converting their mortgages into NHA-MBS. However, this should give a fairly good indication of the cost of complying with the new liquidity rules.

Table 2: Impact on lending spreads of Canadian banks' effort to meet LCR requirement

	(1) **Insured**	**(2)** **Uninsured**
(All figures in millions, unless otherwise specified, based on fiscal year-end 2009)		
Total assets (A)	2,606,946	2,606,946
Total value of loans to businesses and households (B)	1,286,680	1,286,680
Residential mortgages held by banks (C)	195,029	212,671
Cost of conversion to NHA-MBS: (D)	780 (40 bps)	1914 (40+50 bps)
Assumed marginal tax rate (E)	32%	32%
Required change in before-tax net income (F = D/(1-E))	1,147	2815
<u>Estimate of pre-reform average lending rate</u> Net interest income (proxy for "lending spread") (G)	110,069	110,069
Average interest "spread" per dollar in lending (H = G/B)	8.5545%	8.5545%
<u>Estimate of post-reform average lending rate</u> Net interest income on loans – post-reform (I = F+G))	111,216	112,884
Post-reform average interest "spread" per dollar in lending (J = I/B)	8.6436%	8.7733%
Difference between pre- and post-reform average interest spread in bps (J-H)	**9 bps**	**22 bps**