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by

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Abstract

We employ a comprehensive data set and a variety of methods to provide evidence on the magnitude of large banks' funding advantage in Canada, and on the extent to which market discipline exists across different securities issued by the Canadian banks. The banking sector in Canada provides a unique setting in which to examine market discipline along with the prospects of proposed reforms, because Canada has no history of government bailouts. Our results suggest that large banks likely have a funding advantage over small banks after controlling for bank-specific and market risk factors. Working with hand-collected market data on debt issues by large banks, we also find that market discipline exists for subordinated debt and not for senior debt.

JEL classification: G01, G21, G28, G32, G33
Bank classification: Financial institutions; Interest rates

Résumé

À l'aide d'un ensemble exhaustif de données et de méthodes variées, les auteurs cherchent à établir, d'une part, l'importance des avantages de financement des grandes banques au Canada et, d'autre part, le degré auquel la discipline de marché s'applique aux différents titres émis par les banques du pays. Le secteur bancaire canadien constitue un cadre unique pour étudier la discipline de marché ainsi que l'applicabilité des réformes proposées, du fait qu'aucun établissement n'a jamais été renfloué par l'État. Après avoir pris en compte des facteurs de risque propres à chaque établissement et les facteurs de risque communs au marché, ils constatent que les grandes banques semblent jouir d'un avantage de financement sur les petites. S'appuyant sur des données de marché qu'ils ont recueillies manuellement au sujet des titres d'emprunt émis par les grandes banques, les auteurs découvrent également que la discipline de marché s'applique aux titres de dette subordonnée mais non aux titres de premier rang.

Classification JEL : G01, G21, G28, G32, G33
Classification de la Banque : Institutions financières; Taux d'intérêt

1. Introduction

Do banks face market discipline when they raise funds from wholesale deposits and bonds? This is an important question, because current reform proposals aim to increase the incentive of bondholders to monitor banks more effectively, instead of relying on costly government intervention to limit excessive risk taking by large banks. Market-oriented proposals to this end include mandatory subordinated debt, bail-ins and non-viability contingent capital (NVCC) (Evanoff et al., 2011; Evanoff and Wall, 2002; and Basel Committee on Banking Supervision, 2010 and 2011). Under the latter two proposals, the debt holders of a systemically important bank[1] face an administratively imposed or contractual partial conversion of debt into common equity should the bank experience distress. NVCC forces the conversion of a bank's non-common regulatory capital including subordinated debt, while a bail-in extends NVCC and further enhances a bank's capital buffer by forcing the conversion of part of the banks' senior unsecured liabilities as well.[2]

In this paper, we study the extent to which market discipline already exists in the Canadian banking sector. We also investigate whether large Canadian banks have a funding advantage over other domestic banks after controlling for relevant risk factors.

The banking sector in Canada provides a unique setting in which to examine market discipline along with the prospects of enforcing a bail-in mechanism and NVCC because Canada has no history of government bailouts. Further, research has suggested that an implicit government guarantee has been in effect consistently since the 1920s (e.g., Brean, Kryzanowski and Roberts, 2011). In contrast, in the United States, as Flannery and Sorescu (1996) and Balasubramnian and Cyree (2011) argue, market

[1] A systemically important financial institution (SIFI) is a financial institution whose collapse would pose a serious threat to the economy.

[2] In 2013, the Government of Canada proposed to implement a bail-in regime for systemically important banks. It will be "designed to ensure that, in the unlikely event that a systemically important bank depletes its capital, the bank can be recapitalized and returned to viability through the very rapid conversion of certain bank liabilities into regulatory capital." See http://www.budget.gc.ca/2013/doc/plan/budget2013-eng.pdf. D'Souza et al. (2010) discuss in detail the policy implications and rationale for NVCC and bail-in debt.

discipline is observed with error as implicit, too-big-to-fail (TBTF) guarantees have waxed and waned over time. In recent years, the perceived guarantee was undermined by the failure to bail out Lehman and again reinforced by subsequent rescues. This inconsistency in the U.S. government approach to assisting large distressed banks makes Canada a more appropriate environment for study of the too-big-to-fail phenomenon.

In contrast with the United States, the Canadian government has treated large banks consistently over an extended period of time. By examining anecdotal evidence, Brean et al. (2011) show that, since the 1920s, the Canadian system has enjoyed stability grounded on an implicit guarantee for large banks. After the failure of a major bank in 1923, successive governments backed forced mergers as an alternative to failure of a weak bank. This was coupled with a TBTF implicit guarantee for surviving banks. During the Great Depression of the 1930s, when deposit insurance did not exist in Canada, no banks failed, despite deep market-value insolvencies (Kryzanowski and Roberts, 1993 and 1999). As a result of this policy, combined with unrestricted national branching, the Canadian banking sector is dominated by the so-called Big Six banks.[3] At the end of our sample period (i.e., at the end of the fourth quarter of 2010), 28 domestic banks were active in Canada and the Big Six accounted for 93 per cent of total assets.[4] In recent years, banks in Canada have attracted favorable attention since they performed dramatically better than their peers in the United States. Canada did not experience a single bank failure during the financial crisis of 2007–09.

The current study employs a comprehensive data set and a variety of methods to provide evidence on the magnitude of the large banks' funding advantage in Canada, and on the extent to which market discipline exists across different securities issued by the Canadian banks. To address the first objective, we measure the effective interest rate paid on different types of debt as well as credit spreads at the time

[3] These are the Royal Bank of Canada, Canadian Imperial Bank of Commerce, Bank of Nova Scotia, Bank of Montreal, Toronto-Dominion Canada Trust, and National Bank of Canada.
[4] A number of foreign banks also operated in Canada over the sample period as subsidiaries or branches. These banks accounted for a very small share of total assets in the sector.

of bond issuance. An effective interest rate for a debt item is calculated as the interest expense on that item, from a bank's income statement, divided by the level of that debt item from a bank's balance sheets in the same period. We control for market and bank-specific risk factors including various measures for equity (leverage), liquidity and performance. In addition, we introduce controls for additional factors drawn from recent research.

Deposit withdrawals together with required interest rate increases are the two main vehicles available to debt holders to prevent banks' excessive risk taking. Accordingly, we analyze the marginal impact of risk factors to determine whether interest rates act as a monitoring device. If so, changes in firm risk factors should immediately be reflected in a changing interest rate curve. Further, we examine the impact of bank risk on the growth of non-core, wholesale deposits. When market discipline is in force, we expect to see non-core deposit holders withdraw their funds or (at a minimum) deposit less when the deposit-taking banks take on more risk, controlling for other factors.

In the next stage, we investigate the impact of seniority of a debt instrument on its sensitivity to issuers' risk factors for the Big Six systemically important banks.[5] For this purpose, we extract market data on debt (bond) issues. We expect junior debt to be more sensitive to the issuer's risk factors than more senior debt because, in the case of an asset liquidation, junior debt is paid only after senior debt. Pooling subordinated and senior debt in the same sample when examining sensitivity to bank risk (market discipline) could create a bias toward accepting the null hypothesis. If market discipline truly exists, we expect the credit spread on each debt to be sensitive to, first, the issuer's riskiness, and, second, the seniority of debt to be priced. If the market believes that some banks are so systemically important that the government would do anything to protect them from failure (TBTF), then the cost of raising debt for these banks must be generally lower and less sensitive to their riskiness.

[5] We assume that the Big Six banks are the most systemically important banks in Canada due to their relative sizes. Among the Big Six, National Bank of Canada is the smallest. However, its total assets (equal to 153 billion Canadian dollars at the end of 2010) are more than the sum of assets of all non-Big Six domestic banks cumulatively. After the close of our sample period, Canada's federal banking regulator, the Office of the Superintendent of Financial Institutions, validated our assumption by naming the Big Six as "domestic systemically important banks" and subject to a 1 per cent surcharge on risk-weighted capital (Robertson, 2013).

We investigate the determinants of market credit spreads in various securities issued by the Big Six banks over a period of 21 years from 1990 through 2010, hand-collecting a comprehensive sample of their debt issuances and controlling for a host of variables, some of which are related to the banks' risk characteristics while others reflect general market and economic conditions. We group issues by banks into senior and junior buckets using a five-stage bucketing algorithm after studying their contractual features including, but not limited to, their collateral types, maturity, stated seniority, coupon type, redemption features and ratings.

On balance, our findings suggest that large banks enjoy a funding advantage over small banks after controlling for bank-specific and market risk factors. We also find that bank debt in Canada is exposed to some degree of market discipline. Tests on levels and changes in the cost of debt, and also on wholesale deposit growth, show that, during the sample period, the market reacts weakly to banks' risk taking, and that large banks have an advantage in terms of the effective interest they pay on debt.

Working with hand-collected market data on debt issues by large banks, we also find that market discipline exists for subordinated debt and not for senior debt. This is important in light of the heavy reliance of banks on senior debt as a source of funding in the context of resolution plans that are based on the conversion of debt into equity or debt haircuts. The lack of sensitivity to banks' risk of large banks' senior-unsecured debt suggests that a bail-in might be appropriate in encouraging senior debt holders to engage in monitoring banks more effectively. If senior debt holders face credible losses once the bank is judged to be non-viable, there will be increased incentives to monitor bank risk taking ex ante and to charge riskier banks higher interest rates.

Our contributions to the literature are fourfold. First, we consider risk sensitivity (market discipline) for different levels of debt seniority. Second, this study encompasses most of the previous research in this field by drawing on both financial statements and market data to conduct its tests. Third,

we contribute to a better understanding of Canadian banking, a system that is considered one of the soundest in the world. Fourth, our paper provides important policy implications for the design of bail-ins.

The rest of this paper is organized as follows. Section 2 presents a brief review of relevant prior research. Section 3 describes our methodology, and section 4 the data and summary statistics. In section 5 we report our empirical results. Section 6 offers some conclusions.

2. Previous Literature

Market discipline in bank-issued debt has been the focus of many studies over the past two decades (Flannery and Sorescu, 1996; Demirgüç-Kunt and Huizinga, 2004; Driessen, 2005; Krishnan, Ritchken and Thomson, 2005; and Caldwell, 2005, among others). Market discipline initiates when the probability increases that debt holders of a bank will incur losses as banks take higher risks. As a result, debt holders take action to penalize riskier banks by requiring higher rates of return or by withdrawing their funds, causing banks to act more prudently in order to avoid high costs of raising capital. The effectiveness of such market discipline critically depends on the ability of debt holders to price changes in bank risk. Accordingly, research has investigated the extent to which banks' costs of raising debt reflect their riskiness (Avery, Belton and Goldberg, 1988). A part of this literature also highlights the impact of legislation and regulatory interventions on market discipline.[6] Flannery and Sorescu (1996) show that, historically, when U.S. government policy strengthens market perceptions that it would protect liability holders from credit losses, credit spreads on bank bonds show less sensitivity to bank-specific risk factors. In other words, investors have reflected changes in government policy toward absorbing private losses in the event of bank failure. Balasubramnian and Cyree (2011) demonstrate how government intervention in

[6] For a good review of this literature, see Covitz, Hancock and Kwast (2004).

rescuing Long Term Capital Management (LTCM) in 1998 led to a TBTF perception by the market. They show that banks' cost of debt became less sensitive to bank-specific risk after this event.

Measurement of market discipline follows two streams of the literature: the first uses effective interest rates derived from financial statements as a metric (Martinez-Peria and Schmukler, 2001; Demirgüç-Kunt and Huizinga, 2004 and 2010; Hadad et al., 2011), while the second employs bond-issue credit spreads as a gauge of the cost of debt (Flannery and Sorescu, 1996; Krishnan et al., 2005; Balasubramnian and Cyree, 2011). In the first stream, bank characteristics, including their riskiness, cost structure and funding strategies, as well as general market conditions, explain the cost of debt. The second stream uses banks' risk factors, market factors and issue characteristics as explanatory variables. Previous studies choose proxies for liquidity, equity capital and performance as measures of riskiness. Our work seeks to integrate these two streams: we choose similar risk factors for both sets of tests drawn from factors identified in prior studies as important determinants of the cost of bank debt.

Previous studies employ various risk factors as controls, including different measures for equity (leverage), liquidity, performance and size. Balasubramnian and Cyree (2011) find that stock market volatility as a proxy for idiosyncratic risk adds explanatory power to their models. Demirgüç-Kunt and Huizinga (2010) also document relationships between the funding strategy or business model that banks employ and their risk with greater reliance on non-interest income and non-deposit funding, as observed in large and fast-growing banks, associated with increased bank risk. We control for these risk factors when we empirically examine banks in Canada. In addition to measuring the impact of risk factors on the cost of debt, we also examine the impact of a change in risk factors on changes in the cost of debt. If market discipline exists, we expect to see that variations in the cost of debt are explained by variations in risk factors. Krishnan et al. (2005) find significant results for the levels, but not for the first differences.

Balasubramnian and Cyree (2011) show that determinants of yield spread changes are jointly significant only for the period before banks started issuing trust-preferred securities (TPS) in the United States.[7]

In summary, we draw on the previous literature in two ways: first, to identify the most relevant risk factors (bank-specific/market) that theoretically affect the cost of debt for banks and, second, to calibrate banks' cost of debt.

3. Methodology

As explained above, to test for a funding advantage and market discipline for large Canadian banks, we examine both the effective interest rate that is implied by banks' financial statements and the cost of debt extracted from the market data in the form of credit spreads at the time of issuance. Working with financial statements facilitates broad comparisons, since these statements are available in a standard format for all domestic banks. In contrast, the number of bond issues by other domestic banks is insignificant when one compares them with the Big Six. Figure 1, Panel A shows the total amount of bond issues from Bloomberg for the nine largest Canadian banks. We use these market data (on bond issuance) to run our second group of tests in which we focus on large banks to determine whether subordinated debt is more costly than senior debt, and whether subordinated debt is more sensitive to bank riskiness.

3.1 Funding advantage (large vs. small banks) – financial statement measures

Our tests address how each bank's cost of issuing debt is determined by its riskiness (measured by accounting numbers), controlling for market-wide factors and government interest rates. Our methodology for this part follows Martinez-Peria and Schmukler (2001). In choosing risk factors, we follow the recent study by Demirgüç-Kunt and Huizinga (2010), adding a BIGSIX dummy set equal to

[7] TPS are junior to subordinated debt and similar to debentures and preferreds. TPS are generally longer-term, have early redemption features, make quarterly fixed interest payments and mature at face value.

one when a bank is one of the six largest banks, and 0 otherwise. We begin with a single-equation formulation, as follows:

$$\textit{Effective Interest Rate}_{b,t} = A + Bt + C\,(\textit{BIGSIX Dummy}) + D(\textit{Market Risk Factors})_{t-1}$$
$$+ E\,(\textit{Bank Specific Risk Factors})_{t-1} + \textit{error}_{i,b,t}\,, \qquad (1)$$

where *b* represents each bank and *t* represents the calendar quarter of observation. Bank-specific risk factors include equity, defined as the ratio of equity capital to assets as a proxy for bank capitalization; liquidity, the ratio of liquid assets to total assets; and performance, measured by return on investments.[8]

Higher values of equity capital, liquidity and performance are expected to indicate lower bank riskiness for depositors, and hence reduce their expected return. There are endogeneity issues that arise. For example, while higher ratios of equity reduce the likelihood of bank distress or failure, it may also be the case that equity levels increase as interest rates increase. Further, while better performance could reduce a bank's risk, the return on assets (ROA) may be a decreasing function of interest rates, since higher interest rates could reduce profitability. To mitigate these potential issues, lagged risk factors are included in the analysis and a number of robustness checks are provided throughout the paper.

Bank liquidity may be endogenous, since banks could, to some extent, try to avoid market discipline by increasing their equity and/or level of liquidity. To mitigate this possibility, we use a bank's equity and liquidity in the last quarter.

An overhead variable is constructed as the ratio of non-interest expense to assets, to represent a bank's cost structure. Non-deposit funding, the ratio of non-deposit funding to total assets, represents banks' funding strategy. The effective interest rate is the ratio of quarterly interest expense on a debt item to its end-of-quarter balance from consolidated income statements and balance sheets, respectively. Effective interest rates are calculated for different types of liabilities, including total debt, total deposits,

[8] The change in effective interest rates can be expected to be slow and not overly responsive to market or firm risk factors for slowly growing banks, since such changes are primarily determined by the fixed rates on debt already in place for each bank. Such inertia creates a downward bias in the significance of the coefficients for our tests.

wholesale deposits and subordinated debt. Market risk factors reflect general market conditions such as interest rates on Canadian government debt and the unemployment rate. In robustness tests, we replace these with quarterly dummies. Further, following Flannery and Sorescu (1996), Krishnan et al. (2005), and Balasubramnian and Cyree (2011), who find that the impact of risk variables changes over time in the United States, we run separate models for the crisis period and a pre-crisis period.

We next employ a two-stage model to control for the impact of the funding and maturity mix. In other words, we want to rule out the possibility that differences in interest costs result from variety in the funding mix and maturity, rather than from differences in bank riskiness. We first estimate the expected interest costs on deposits as a function of their maturity and funding mix, and use the residual as a spread variable in the second-stage analysis, in which we measure the too-big-to-fail impact. In the first stage of the "two-stage" analysis, effective interest rates are regressed on the funding mix and maturity mix variables. The variables used to characterize the funding mix are the proportions of: (i) demand and notice deposits and (ii) fixed-term deposits. These shares are further broken down into: (a) federal and provincial, (b) municipal and school corporations, (c) deposit-taking institutions, (d) individuals and (e) other. To conduct the first-stage estimation, one share (in this case, the fixed-term federal and provincial share) is excluded. This specification enables us to investigate the impact of the funding mix on deposit interest expense.

The first-stage is an estimation of interest costs based on funding granularity, as shown in equation (2), and the second stage is estimation of the interest cost residual, which is the actual minus the predicted interest cost, based on bank riskiness, BIGSIX status and other controls (equation (3)):

$$\textit{Effective Interest Rate}_{b,t} = A + B\,(\textit{Funding Mix/ Maturity Mix})_{t-1} + \textit{Residual Term}_{i,b,}, \quad (2)$$

$$\textit{Residual Term}_{i,b,t} = A' + B't + C\,(\textit{BIGSIX Dummy}) + D(\textit{Market Risk Factors})_{t-1} + E\,(\textit{Bank Specific Risk Factors})_{t-1} + \textit{error'}_{i,b,t}. \quad (3)$$

Equation (3) is the same as equation (1) except that a spread variable is used instead of the actual cost. Because funding and maturity mixes are available only for deposits, we limit our two-stage analysis to this interest cost category.

Returning to our original single-equation model, we conduct first-differences analysis to study the impact of *changes* in related risk factors on the *changes* in effective interest rates. Following Krishnan et al. (2005), we analyze the marginal impact of risk factors, since one of our goals is to test whether interest rates act as a monitoring device. In this case, changes in firm risk factors should immediately be reflected in a changing interest rate curve. Our next models are as follows:

$$\textit{Change in Effective Interest Rate}_{b,t} = A + Bt + C\,(\textit{BIGSIX Dummy})$$

$$+ D\,(\Delta \textit{Market Risk Factors})_{t\text{-}1} + E\,(\Delta \textit{Firm Specific Risk Factors})_{t\text{-}1} + \textit{error}_{i,b,t}, \qquad (4)$$

where Δ represents a change from t-1 to t, such that

$$\Delta \textit{Risk Factor}_{t} = (\textit{Risk Factor}_{t} / \textit{Risk Factor}_{t\text{-}1}) - 1. \qquad (5)$$

In addition, as a robustness check and following Martinez-Peria and Schmukler (2001), we employ quarterly growth in real deposits as an alternative measure of whether deposit holders react to a bank's riskiness. In the presence of market discipline, we predict that an increase in the riskiness of a bank will negatively affect the growth in uninsured and/or non-core deposits. Uninsured deposits are not guaranteed by the Canada Deposit Insurance Corporation (CDIC), a federal Crown corporation created in 1967 and currently insuring deposits up to 100,000 Canadian dollars. Core deposits are made by customers in the bank's general market area who tend to be loyal and consistent. Both core deposits and insured deposits are considered less sensitive to economic changes or bank riskiness than other bank debt. Detailed data for the portion of deposits that is uninsured or non-core are not available; however, we use

wholesale deposits (deposits not open to individuals) as a proxy.[9] The model for this part has the following format:

$$\textit{Real Growth in Wholesale Deposits}_{b,t} = A + Bt + C(\textit{BIGSIX Dummy}) +$$

$$D(\textit{Market Risk Factors})_{t-1} + E(\textit{Firm Specific Risk Factors})_{t-1} + \textit{error}_{i,b,t}. \quad (6)$$

The accounting data we use are at the consolidated level and include Canadian bank operations outside Canada, especially in the United States. Ideally, we should run the model only for domestic operations, since banks differ in the ratio of foreign to domestic operations. In practice, however, the definition of foreign/domestic operations is not clear, since domestic operations potentially include all transactions performed by domestic branches of Canadian banks, as well as all transactions in the domestic currency. Historical data show that both domestic and foreign branches of Canadian banks have issued debt in both domestic and foreign currencies and sold it to foreign/domestic clients. Over the years, Canadian banks have issued debt in more than 20 currencies. While some distinctions among currencies are provided for, in reporting accounting items, the data include no breakdown between foreign and domestic branches. Due to integration of financial markets, there is no reason to believe that the market's perception of implicit government guarantees of large banks differs between foreign and domestic bondholders. Moreover, there is no indication in issued debt terms and conditions that Canadian and non-Canadian investors will be treated differently at the time of bankruptcy. Therefore, using data at the consolidated level should not cause any systematic bias when we examine funding advantages.

3.2 Market discipline for large banks – bond market yield spreads

Following Flannery and Sorescu (1996), Krishnan et al. (2005), and Balasubramnian and Cyree (2011), our variable of interest is each deal's issuance spread.[10] In contrast with these studies, we consider

[9] The growth in deposits can be internal growth or growth by acquisition. In the latter case, a presumption might be created toward accepting the null hypothesis if a risky bank increased its wholesale deposits by acquiring another entity. Historical data, however, show that the overall size of the wholesale deposits that belong to acquired entities is negligible. This point notwithstanding, our empirical results for wholesale deposits are consistent with our other results.

only spreads at the time of issue, because most of the securities in our sample are not actively traded in the secondary market. We use all available debt issues by banks to estimate the following regression for yield spread:

$$Spread_{i,s,b,t} = A + Bt + Cb + D(Market\ Risk\ Factors)_{t-1} + E(Firm\ Specific\ Risk\ Factors)_{t-1} + F(Issue\ Specific\ Characteristics)_{i,s,t} + error_{i,s,b,t}\ , \quad (7)$$

where *i* represents each issue, *s* represents a different seniority level, *b* is a bank fixed-effects dummy and *t* represents time of issuance. Bank-specific risk factors are similar to those in equations (1) and (2) with the addition of bank asset size. We drop the Big Six dummy here, since all our spread observations are from Big Six issuers. Market risk factors include those in equation (1) as well as the return on the market index (measured by the TSX index), market volatility (measured by the VIX index) and market liquidity measured by the slope of the term structure (10-year treasury rates minus two-year treasury rates). In addition, issue-specific characteristics that affect yield spreads include redemption features such as callability, issue amount and bank size measured by log (assets). We run this regression separately for different seniority levels and for different currencies in which banks have issued debt. We expect to see greater sensitivity to risk factors for less-senior securities.

Krishnan et al. (2005) and Balasubramnian and Cyree (2011) conduct their tests on U.S. bond transaction data from the National Association of Insurance Commissioners (NAIC) database from 1994–99. These data allow the authors to construct a first-differences model, in which changes in spreads are regressed on changes in risk factors. In the Canadian market, however, transaction data are not available for most banks in our sample, because the secondary market is not active for most securities and there is no central database that reports bond transactions for those bonds that are traded. We employ only the market data on issue prices (explained in detail in the next section) hand-collected from Bloomberg. As a

[10] Other possible candidates that are used in industry or academia to measure the cost of raising debt are banks' ratings and credit default swap (CDS) spreads. The former does not provide enough variation for testing, while the latter is also not practical, since certain banks do not have an active CDS market. Therefore, we follow the most common methodology in the literature and use credit spreads as a proxy for cost of debt.

result, for each bond, we have one observation and, therefore, we cannot follow price changes in a specific security.[11]

4. Data and Summary Statistics

Historical bank financial statements, exchange rates and treasury rates for the Canadian economy are extracted from the database of the Bank of Canada. Market indicators including the VIX and TSX indices are taken from the Center for Research in Security Prices (CRSP). Detailed information related to debt issues is hand-collected from Bloomberg.[12] The advantage of choosing Bloomberg over other sources is its comprehensiveness.[13]

Our sample includes all banks that have been active during recent decades, but excludes trust and loan companies. We restrict the sample to the 1990–2010 period, for two reasons: first, to be consistent with the available market data that we use for spread analysis and, second, since the required reporting format of financial statements has changed over time, using older data might cause inaccuracy in our analysis.[14] Further, we screen out subsidiaries of foreign and domestic banks, since their funding strategies/costs are not independent of their parents. We also exclude all foreign banks and banks originally established under other jurisdictions. This leaves us with a sample of 2,436 domestic bank-quarters. A total of 672 observations were made by banks that became inactive during our sample period – typically, small banks that experienced difficulties and were then bought and merged into larger banks.

[11] Studies conducted in the United States and that have used transaction data are limited to restricted samples and data sources. Most of these studies have used Warga, a data set that has not been available since 1998. Balasubramnian and Cyree (2011) explain this in detail.

[12] Bank debt securities can be found within two of ten market sectors in Bloomberg, namely Corporate Debt (CORP) and Preferred Shares (PFD). Other market sectors are government, mortgage-related, money market, municipal or state, equity, commodity, index, or currency securities. Bloomberg includes debt issued after January 1981.

[13] Mergent and Thomson Reuter's SDC Platinum, for instance, do not provide data on short-term debt; i.e., maturity of one year or less. Mergent does not cover issues outside the United States. SDC also does not provide data on issues less than US$1 million. Other Canadian sources do not cover issuances by foreign subsidiaries of a Canadian bank.

[14] In 2009, there were around 30 domestic banks reporting to the Bank of Canada; there were also about 55 foreign banks active. Moreover, these exclude about 45 foreign and domestic banks that stopped reporting to the Bank of Canada during the period ending 2009. In addition, there were around 60 institutions that reported to the Bank of Canada as trust and loan companies.

Because such problem banks usually face a higher cost of funding before becoming inactive, including them in our sample could create a bias in favor of our hypothesis of a funding advantage for the Big Six.[15] Therefore, we omit all observations related to these banks. Our final sample includes 1,764 observations, representing six large and 15 small domestic banks.

To provide perspective on our financial statement data, Figure 2 shows that deposits constitute the main source of funding for Canadian banks. On average, deposits are around 65 per cent of large banks' and 83 per cent of small banks' total liabilities and equity, reflecting the tendency of smaller banks to follow a more traditional model of banking by funding a higher proportion of their assets through deposits. In addition, these figures show that studies that consider only bond spreads to examine whether large banks have a funding advantage may be incomplete, since they ignore the largest sources of funding for banks. Figure 2 also shows that, on average, smaller banks hold higher levels of equity than large banks. In addition, the average amount of subordinated debt across all groups of banks is at most 2 per cent. This is important, since regulators are considering non-viability contingent capital as a way of limiting larger banks' funding advantage and excessive risk taking. Under NVCC, upon a determination of non-viability, all non-common regulatory capital instruments are permanently converted into common shares of the bank, providing additional capital before taxpayers are involved.[16] The outstanding amount of subordinated debt may not be sufficient to recapitalize a failing bank in Canada.[17]

Figure 3 reports the total cost of debt for Canadian banks over time for large and small banks and shows that, overall, the cost of debt has dropped from 1990 to 2010, consistent with the downward trend in interest rates. Figure 3 also reveals that large banks, on average, have paid lower effective interest rates over time, supporting the hypothesis that they enjoy a funding advantage over smaller banks in the Canadian economy. We examine this finding in more detail in our multivariate analysis. Finally, the

[15] The banks that become inactive are typically riskier, with lower performance ratios. Adding these banks to the sample would make our results even stronger, since they pay higher interest rates on their issues.
[16] For more details regarding NVCC in Canada, see http://www.osfi-bsif.gc.ca/Eng/Docs/nvcc.pdf.
[17] D'Souza et al. (2010) discuss how contingent capital, together with bail-in debt, with the same conversion triggers, could increase the amount of private sector capital available at the point of non-viability to effectively support the restoration of a failing bank.

figure shows that the cost of debt is highly correlated with government rates, proxied by quarterly (3-month) treasury rates.

4.1 Market data

We hand-collect detailed information for all debt issues by the 11 largest banks active in Canada by searching their tickers on Bloomberg.[18] Reported market data on the remaining domestic banks are negligible. This gives us a total of 12,224 issues, which includes all debt issued (excluding preferred stock) by all banks' domestic and foreign branches on Bloomberg. We omit those issues that have missing or non-positive amounts, leaving 10,267 observations. For reasons explained earlier, we restrict our sample to issues from the beginning of 1990 through the end of 2010, and this leaves us with a sample of 10,148 observations. A total of 339 observations belong to non-domestic banks and credit unions that report their financial statements under different regulations (the only institution with such characteristics is Caisse centrale Desjardins in our sample); 9,805 observations are related to domestic banks.

Figure 1, Panel A shows the total gross amount issued by each bank over the sample period across 25 different currencies. Issue amounts in other currencies are converted to Canadian dollars using the exchange rate as of the issuance date and inflation-adjusted (base year 2005). Panel A shows that total bond issuance is dominated by the Big Six Canadian banks. The largest total gross amount other banks have issued is Can$2,352 million, by Laurentian, which is not comparable to the Can$36,532 million issued by the smallest of the Big Six (National Bank of Canada). We focus exclusively on bond issues by the Big Six, and this brings our sample size down from 9,805 to 9,766 issues.

The next step is to assign the issues to four buckets based on their seniority. If market discipline exists, one expects to see credit spreads sensitive to banks' specific risk factors. In other words, the

[18] These banks are Royal Bank of Canada, Toronto-Dominion Bank, Bank of Nova Scotia, Bank of Montreal, Canadian Imperial Bank of Commerce, National Bank of Canada, HSBC Canada, Caisse centrale Desjardins, Pacific & Western Bank of Canada, Canadian Western Bank and Laurentian Bank of Canada. HSBC Canada is the only foreign bank in this list. The Caisse centrale is a representative of the Desjardins Group, which is an association of credit unions.

market should react to the amount of risk a bank takes by requiring a higher return on investment when an issuer bank takes a higher risk, and vice versa. Also, one expects to see junior claims exhibit greater sensitivity to an issuer's riskiness than senior claims, since their holders are more exposed to the risk of not receiving principal or coupon payments. Accordingly, we assign each debt issue to a bucket based on its seniority, which is its priority over other securities issued by the same issuer with respect to the payment of coupons and/or repayment of principal. We do this after studying the relevant contractual features reported on Bloomberg. Securities in different buckets differ in their potential for recovery in the event of an issuer's default.[19] We define four general buckets: secured, senior unsecured, subordinated and junior subordinated. The last bucket has priority over preferred and common stocks.[20] The seniority bucketing procedure is fully explained in an appendix available on request from the authors.

This procedure yields the following sample distribution, along with each bucket's total amount (only amounts related to the Big Six banks are reported): bucket 1 (secured): 31 deals, Can$38.4 billion; bucket 2 (senior unsecured): 9,224 deals, Can$1,025.0 billion; bucket 3 (subordinated): 440 deals, Can$107.6 billion; and bucket 4 (junior subordinated): 71 deals, Can$21.3 billion. As stated earlier, the relatively small amount of subordinated debt suggests that regulators would likely have to consider bail-ins as an additional tool to recapitalize Canadian banks.

4.1.1 Credit yield extraction

Credit yield spread is defined as the difference between a bond's yield to maturity and that of a corresponding Government of Canada security with the same time to maturity. Following Krishnan et al. (2005) and Balasubramnian and Cyree (2011), we use the cubic-spline interpolation method, which

[19] Standard & Poor's (2008), for instance, provide the following hierarchy for the relative seniority of all claimants of a company (based on U.S. insolvency jurisdictions): super-priority claims, such as DIP financing; administrative expenses; federal and state tax claims; senior secured claims; junior secured claims; senior unsecured debt and non-debt claims; subordinated claims; preferred stock; and common stock.

[20] Junior subordinated debt is assumed to have the same priority as preferred shares in some classifications. They are mostly perpetual securities with high fixed coupon rates (similar to preferred stock), but since Bloomberg identifies preferred stocks under a different market sector, we treat these securities differently. All junior subordinated debt in our sample is callable.

captures the non-linear aspects of the yield curve and extracts the entire daily yield curve of related Canadian securities. Related information for Canada rates comes from the central bank's publications.

To be consistent with our data source, we use Bloomberg's method of calculating yields to maturity at issue. Yield to maturity of a fixed-rate plain-vanilla (no redemption feature) coupon bond is calculated as the internal rate of return, considering market price at issuance, coupon rate and time to maturity. Yields to maturity for floating/variable-rate bonds are calculated assuming that future interest rates are based on a forward interest rate curve at the time of bond issuance and the bonds' expected cash flows. Spreads are then winsorized at 10 per cent to eliminate any extreme values resulting from errors in reporting. A total of 2,687 observations have all the required detail to calculate credit spreads.

4.1.2 Summary statistics on market data

To compare bonds in the senior and junior buckets and to measure their sensitivity to bank-specific and macro risk factors, we focus exclusively on issues in Canadian dollars by the Big Six Canadian banks. We omit observations that belong to bucket 1 (senior secured) and bucket 4 (junior subordinated), for two reasons. First, the sample size in each bucket is not sufficient to perform statistical analysis. Second, the nature of securities in these buckets is different from those of buckets 2 and 3. The first bucket is secured, so spreads are influenced by the riskiness of the collateral, and we do not have sufficient information to study the collateral. Securities in bucket 4 are also different in nature, since most of them are perpetual. Therefore, comparing their yields to maturity to yields on bonds that mostly mature within five years could create inaccuracies in statistical analysis. Of 2,687 observations with valid spreads, 805 are issued in Canadian dollars and are either senior unsecured (bucket 2) or subordinated (bucket 3). Total issues across different maturity levels and coupon types are reported in Figure 1, Panels B and C. Most of the issued debt matures within five years and has a fixed- or a floating-rate coupon.[21]

[21] Less than 5 per cent of bonds issued by Canadian banks in the sample have other coupon types such as zero-coupon, step coupon, etc.

We also omit bonds with puttable or convertible redemption features. This brings our sample size down from 805 to 799. While we prefer to work only with plain-vanilla bonds with no redemption features, if we were to omit all callable securities we would encounter a sample-size problem. Therefore, we follow the related literature that has utilized the information conveyed by bonds with different redemption features (Bhojraj and Sengupta, 2003; Deng et al., 2007) and retain callable securities. We calculate their spreads, assuming that the security is held to maturity, but control for the redemption features when we run the regressions.

Table 1 provides summary statistics for all Canadian issues with calculated spreads used in our empirical analysis time to maturity, and issue amounts across different seniority levels. The results from Table 1 are consistent with the risk characteristics of the two main debt groups, and verify the accuracy of our bucketing algorithm. Subordinated debt has higher mean and median spreads and a longer maturity. The number of subordinated issues is less than the number of senior unsecured issuances, and average/median subordinated issuance carries a larger dollar value than average/median senior unsecured debt.

5. Empirical Results

This section reports the results from the empirical analysis of the cost of debt derived from financial statements and market data. Table 2 provides dependent and explanatory variables that are used in the multivariate analysis.

5.1 Interest expense analysis based on financial statements

Table 3a shows single-equation estimates for interest paid on total debt, total deposits, wholesale deposits, and subordinated debt that are inferred from quarterly income statements and balance sheets (equations (1) and (4)). Time effects are not reported, to save space. Using these interest rates for cost-of-debt analysis has the advantage that they can be constructed for all reporting banks in the economy. A disadvantage, however, is that these interest rates might provide noisy estimates of actual costs of debt,

because each category (total debt, deposits, subordinated debt, etc.) is a combination of different securities with varying contractual features. In particular, deposits can be insured or uninsured and we know that insured deposits are likely less sensitive to risk factors. However, as explained above, there is no clear distinction between insured and uninsured deposits in Canadian bank financial statements. As a proxy for interest on uninsured deposits, we also use interest paid on wholesale deposits (deposits by non-individuals). This proxy is not completely accurate: while all deposits above Can$100,000 are not insured, not all deposits below this amount come from individual depositors. We refine this distinction in our two-stage tests below. Measurement error also exists in the subordinated debt category, which is not broken down in financial reports but can include securities with different maturities and contractual features.

A further complication arises from the way our proxies for cost of debt are constructed from financial statements by dividing total interest paid on that category during a quarter (extracted from a banks' income statement) by the balance of that category of debt at the end of that period (extracted from the balance sheet). This calculation is affected by measurement errors, since a security might expire before a period ends, and therefore disappear from the end-of-period balance sheet, while its cost is calculated in the income statement. Similarly, a new security may be issued near a quarter end, in which case the figure on the balance sheet would not be proportionate to the cost reported in the income statement. However, since this error is not systematic, we use implied interest expense analysis to infer whether large banks have a funding advantage here, and in the next section we focus on market data that are not affected by these problems.

5.1.1 Single-equation tests

The results reported in Table 3a show that different sources of funding respond to bank risk taking. In particular, the liquidity ratio has a significant negative effect on most costs of funding. The coefficient for return on investment is significantly negative for interest paid on subordinated debt,

showing that profitable banks pay lower interest on their subordinated debt. As expected, government interest rates, measured by three-month treasury rates, directly and positively affect the cost of debt for banks. This is also supported by Figure 3, which shows that the cost of debt in both small and big bank categories moves together with government rates.

The principal variable of interest in these models is the dummy variable BIGSIX. Table 3a shows that, on average, the Big Six Canadian banks pay around 80 basis points less for their deposits than other domestic banks. They also pay about 70 basis points less on their subordinated debt compared with smaller banks. A 70 basis points funding advantage on term and fixed (but not wholesale) deposits and subordinated debt corresponds roughly to one-third of the Big Six banks' net income in 2010. These findings support the hypothesis that big banks have a funding advantage over small banks. In contrast, Table 3a illustrates that the Big Six banks do not pay less for wholesale deposits. These deposits are made by sophisticated investors (e.g., other financial institutions, non-financial corporations, foreign entities, money market mutual funds) who are quick to "run" in the face of adverse information about the bank. Results suggest that wholesale depositors may not accept a lower interest rate from a Big Six bank.

The coefficients for two of the control variables – non-deposit funding and overhead – are of opposite signs for subordinated debt versus other types of debt (deposits), and significant. Greater dependence on non-deposit funding reduces the risk for deposit holders, while subordinated debt holders require higher returns if banks rely more heavily on non-deposit sources of funding (1 basis point for a 1 per cent increase in the ratio of non-deposit liabilities to total assets). The coefficient for performance, measured by return on investment, is significant only for subordinated debt with a negative sign, as predicted. On average, everything else held constant, subordinated debt holders charge a bank 20.6 bps less if the bank has shown 100 bps better performance (measured as net income to total assets) over other banks at the end of the previous period. The results suggest that subordinated debt holders believe that better-performing banks are less likely to default on their debt and therefore are less risky.

The findings for overhead costs are counterintuitive. For subordinated debt and wholesale deposits, the coefficient is positive, meaning that higher overhead cost increases the risk for these instruments. However, for total deposits and total debt, the coefficient is negative. The results are likely driven by core and insured deposits, since higher overhead costs (e.g., personnel and building costs) decrease the margin for core/insured deposit holders. Subordinated debt holders and non-core deposit debt holders, however, require higher returns (1.2 and 6.8 bps, respectively) per 1 per cent increase in the ratio of overhead costs to total assets. Overall, the results for overhead costs support the notion that banks rely more heavily on core depositors to support overhead costs.

Our conclusion that the Big Six banks pay less for deposits might be subject to an alternative explanation: these banks draw retail deposits from their branch networks to a greater extent than smaller banks that rely principally on Internet deposits and deposit brokers. It would be of interest to find data on this reliance and to separate core deposits. Core deposits are considered a stable source of funds and are generally less sensitive to changes in short-term interest rates and bank risks than other forms of deposits. However, as discussed earlier, identifying core deposits is not practical considering the format in which Canadian banks report their deposits. Another way to address this is to use wholesale deposit growth as a robustness check. Table 3a shows the results for real wholesale deposits' quarterly growth and reveals that banks with better liquidity, and banks that, on average, have higher overhead costs, are able to attract different sources of funding and have higher wholesale deposit growth over time. Further, higher interest rates attract more deposits to the banks as holding cash becomes more costly for investors. Most importantly, demonstrating the robustness of our prior findings, the Big Six banks attract more deposits over time and have a higher wholesale deposit growth.

Table 3b provides results of an alternative specification for comparison. As the risk factors of each bank vary, so too could the funding advantage of the big banks. In Table 3b, the BIGSIX dummy variable is interacted with each risk factor. All the variables included in Table 3a are also included in this specification. The interaction terms of the BIGSIX dummy with bank risk factors enable us to estimate

whether an explicit deposit insurance system reduces or enhances market discipline. Results are qualitatively similar to those provided in Table 3a. In particular, once interaction terms are included, the Big Six Canadian banks pay around 110 basis points less for their deposits than other domestic banks.[22]

To examine whether unobservable market risk factors affect the results in Table 3a, we use quarter effects (dummy variables) to replace year effects and market risk factors in Table 4. The results in Table 4 show that the findings in Table 3a are generally robust to our choice of controls for market risks. In particular, the Big Six have the same negative coefficient for interest on deposits and subordinated debt and the same positive sign for real wholesale deposit growth as previously. Unlike Table 3a, there is now a negative sign on the Big Six dummy in the regression of interest on wholesale deposits, but the coefficient is no longer significant.

5.1.2 Two-stage tests

Table 5 reports the results for funding and maturity mix analyses for deposits with the market characteristic controls employed in Table 4 (equations (2) and (3)). While the proportions of insured and uninsured deposits are not available from financial reports, we have access to the mix of deposits in two categories: (i) demand and notice deposits, and (ii) fixed-term deposits. Each of these categories is further broken down into (a) federal and provincial, (b) municipal and school corporations, (c) deposit-taking institutions, (d) individuals and (e) other. This enables us to investigate the impact of the funding mix on deposit interest expense. In addition, the largest banks voluntarily report the maturity mix of their deposits when they discuss interest rate sensitivity in their annual reports.[23] The funding mix is available for all banks in our sample (Model 1 in Table 5, Panel 1).[24] The maturity mix is available from annual reports

[22] Further, with respect to the interest rate paid on deposits: the larger the equity, liquidity, overhead and non-deposit funding, the larger the funding advantage of the Big Six banks.

[23] The maturity mix data are available for nine banks in our sample from 1997–2010 annually. To extract these data, we used the System for Electronic Document Analysis and Retrieval (SEDAR). Available at www.sedar.com, SEDAR is the electronic filing system for the disclosure documents of public companies and investment funds across Canada.

[24] The share of fixed-term funding from federal, municipal and school corporations is generally small for banks, on average (Shares of funding: FT-federal and provincial=0.17% and FT-municipal and school corporations=0.19%).

for only nine banks[25] from 1997 to 2010 (Model 2 in Table 5, Panel 1). Ideally, we should use both funding mix and maturity mix variables in one regression; however, due to high correlations between these components, the inclusion of both sets of variables provides statistically unreliable results. The funding and maturity variables are in percentage formats.[26]

The focus of this analysis is the coefficients in Panel 2. The results confirm our previous findings and show that our conclusions about funding advantage and market discipline are not driven by differences in the funding/maturity mix. The coefficients in the two-stage analysis for the cost of deposits here bear the same signs and significance as those in our earlier single-equation regressions for a broader list of cost variables. Results indicate that, on average, the Big Six Canadian banks pay between 20 and 30 basis points less on their demand and fixed deposits than other domestic banks after controlling for differences in banks' funding/maturity mix.

The only contradictory point is the coefficient on overhead costs in both models, which is significantly positive for the funding mix regression (Model 1) and significantly negative for the maturity mix regression (Model 2). As explained earlier, overhead proxies for a bank's cost structure. Because the first model uses all the sample banks and is therefore dominated by non-Big Six banks, and the second model uses data for only nine banks, dominated by the Big Six, different signs might result from including banks with different cost structures in each sample.

To test the robustness of our two-stage model, we repeat the test from our single-equation analysis, replacing the year effects and market risk factors with quarterly dummies. The results (not reported) confirm that our findings are robust to this change.

Therefore, it is not expected that the first-stage regression will eliminate the heterogeneity in interest rates stemming from differences in the funding mix.

[25] The nine banks are the Big Six plus the Canadian Western Bank, Pacific & Western Bank of Canada and Laurentian Bank of Canada.

[26] Estimates may be potentially biased, depending on the reliance of the Big Six on non-Big Six bank deposits, or the reliance of the non-Big Six on Big Six bank deposits. Without a proper breakdown of deposits by type and size of institution, it is not possible determine the direction of the bias.

In summary, these two-stage tests for deposits establish the robustness of the findings of our single-equation models. We next return to the single-equation setting for further robustness testing.

5.1.4 Changes in effective interest rates

Results for the first-difference regressions for the single-equation model are reported in Table 6. Changes in interest rates are regressed on changes in risk factors across different quarters, following equation (4). The results show that risk factors are playing a marginal role in changes in interest rates. Interestingly, the coefficient for the change in equity becomes significant for total liabilities and deposits, while, earlier (Tables 4 and 5), the coefficients for equity were insignificant. A larger positive change in equity is associated with a greater decrease in the cost of debt, supporting the notion that higher levels of equity make a bank less risky. The significance of the change in equity, but not the level, could arise from regulatory restrictions on the level of equity, whereas periodic changes in equity might be due more to bank-specific situations. To analyze this further, in unreported regressions we introduce the change in equity as an additional variable in Tables 3 and 4. The signs and significance of the results do not change, and the coefficient for change in equity is insignificant. In the sole case of interest on total liabilities (Table 3a, first model), when we add the change in equity, the coefficient for the level of equity becomes negative and significant (the significance and signs of other variables do not change). This suggests that, overall, the total cost of debt decreases as the level of equity becomes higher after controlling for shocks to the level of equity.

In addition, Table 6 shows that banks' funding strategies matter in explaining changes in effective interest rates. A positive change in the ratio of non-deposit funding is associated with a negative change in the cost of raising deposits and total liabilities, but has no significant impact on the cost of subordinated debt.

While, on balance, the results in Table 6 support the hypothesis that Big Six banks enjoy a funding advantage, coefficients on the BIGSIX dummy are not significant for interest on deposits and for

interest on subordinated debt. Comparing the adjusted R-squared of different regressions, we find that, in general, levels are explained better than changes, consistent with Krishnan et al. (2005). For instance, the adjusted R-squared for the level of interest on liabilities regression in Table 3a is 80.4 per cent, whereas the same statistic for the first-difference (change) regressions for interest on liabilities is 15.41 per cent in Table 6. Among first-difference regressions, changes in wholesale deposits and subordinated debt are better explained by changes in risk factors (44.16 per cent and 27.48 per cent, respectively) than by changes in other types of debt.

In summary, the results from Tables 3 to 6 show that, in general, banks in Canada are exposed to a degree of market discipline and that the Big Six Canadian banks have a funding advantage over other domestic banks. The next section provides a different type of analysis by using market data on bond spreads.

5.2 Bond credit spreads analysis

In this section, we report results from estimation of a fixed-effects ordinary least-squares model for all issues in Canadian dollars across two main seniority buckets. Credit spreads are regressed on market and bank-specific risk factors, and issue characteristics. If market discipline exists, we expect to observe significant sensitivity of yield spreads to bank-specific risk factors. In coordination with the empirical analysis performed in the previous section, we use the common set of explanatory variables defined in Table 2 and discussed above.

Bank-specific risk variables are lagged one period and represent the most recent information that bond investors have with respect to banks' accounting statements. We control for size, performance (ROA), liquidity[27] and equity capital calculated from financial statements. In addition, following Balasubramnian and Cyree (2011), we utilize the variance of stock prices (adjusted for splits by

[27] Liquid assets are measured as the sum of cash and cash equivalents, securities issued or guaranteed by Canada/Canadian provinces/Canadian municipal or school corporations and non-mortgage loans, less an allowance for impairment restricted to call and other short loans.

Bloomberg) over the prior period as a further control variable. The other risk factors are consistent with the first sets of tests that we run for effective interest rates. Additional variables (in Balasubramnian and Cyree) that we do not use are either highly correlated with the ones we include or unavailable for Canadian banks.

Spreads are also affected by general market conditions and banks may time the market by issuing debt when demand is high. We include five market factors to control for market conditions, all measured at the most recent quarter end before issuance. Market volatility is measured as the average level of the Chicago Board Options Exchange Market Volatility Index (VIX) over 30 trading days before the security issuance date. Market return is the return on the TSX index (the main stock market index in Canada) over the 30 trading days before issuance date. Three-month treasury rates represent the government interest rate, and ten-year minus two-year treasury rates is a measure for liquidity in the market inferred from the term structure of government rates.

Bond-specific features follow Balasubramnian and Cyree (2011), Bhojraj and Sengupta (2003) and Deng, Elyasiani and Mao (2007) to control for bond riskiness and liquidity, and include issue amount, coupon payment frequency, redemption features (callability), time to maturity and whether the bond is a fixed-rate or a floating-rate issue. These features can impact the demand for a bond and thus its cost of issue and liquidity. In addition, coupon rates control for tax effects.[28]

We report the regression results in Table 7 for senior unsecured and subordinated debt issues. As noted earlier, all the observations here are from Big Six banks and consequently we drop the Big Six dummy. The regressions include year and issuer fixed effects. The coefficients for two bank-specific risk factors (size and equity) are statistically significant for the subordinated issues, but none of the bank-specific variables are significant for the senior unsecured issues. This suggests that the Big Six Canadian banks are exposed to bond market discipline exclusively via their subordinated debt. Investors in the

[28] Balasubramnian and Cyree also use a dummy for sinking-fund bonds. The number of such bonds in our data after employing the screening process described in the methodology section above is insignificant.

subordinated debt market adjust their required rate of return after observing the issuer's level of equity capital over the previous quarter, and banks with higher equity capital have lower credit spreads. Further, Table 7 shows that even among the Big Six banks, larger banks (as measured by the log of assets) pay lower interest rates on their subordinated debt. The results also show that fixed-rate bonds have higher spreads, consistent with their greater exposure to interest rate risk relative to floating-rate bonds. Finally, the coefficient for coupon rates is significantly positive, as in Balasubramnian and Cyree (2011), reflecting the higher tax attracted by higher coupon securities.[29]

In summary, the results reported in this section regarding the Big Six banks' subordinated debt provide some support for the existence of market discipline; however, senior debt holders do not price bank riskiness in their required rate of return. This is consistent with the fact that in the event of a bank's default, subordinated debt holders are paid only after senior debt holders are fully compensated, supporting the too-big-to-fail argument and the notion that investors believe in an implicit government guarantee at least in the senior unsecured liabilities sector.

5.3 Market discipline analysis

Given our finding that market discipline exists for the Big Six, it should be present for non-Big Six banks to a greater degree. Because market data for bonds issued by non-Big Six banks is scarce or not available, we return to our earlier setting in which we derive interest costs from financial statements. We now measure interest on total liabilities separately for the Big Six and the other banks. The set-up is similar to that in Table 3a, with the Big Six dummy excluded since the regressions are sorted by the Big Six and the other banks. In addition, we use a measure of bank size and control for bank fixed effects.

The results reported in Table 8 show that both the Big Six and the other banks are exposed to market discipline as coefficients for selected measures of bank risk attain significance in both regressions,

[29] In the previous section, we performed a pre- versus post-crisis analysis. It would be interesting to conduct the same type of analysis for the spreads; however, our sample size restricts us from doing so. In our screened sample, there are only 18 subordinated debt issues during the crisis period (2007–09) and 54 for the pre-crisis period.

suggesting that bank risk affects the cost of debt. The effect is more observable for the other (non-Big Six) banks. Of interest is the coefficient for bank size, measured as log (assets). Table 8 shows that the cost of debt is sensitive to bank size for the smaller, non-Big Six banks, but not for the Big Six banks, providing further support for our TBTF argument. An alternative explanation is that size variations may be greater for smaller banks over the sample period.

6. Conclusion

Larger banks are effectively shielded from market discipline if the market perceives that they will be bailed out in times of distress. To alleviate moral hazard problems and to control banks' excessive risk taking, proposed reforms seek to minimize government intervention and to enhance the incentive of bondholders to monitor banks more effectively. Two major proposals designed specifically for the resolution of failed/close-to-failure large banks with emphasis on market mechanisms are non-viability contingent capital (NVCC) and debt bail-in. Under the former, subordinated debt converts into equity (upon a trigger at the point of non-viability), providing additional capital before taxpayers become involved. A bail-in extends NVCC to enhance a bank's capital buffer, forcing senior creditors to bear losses by contributing to the recapitalization and, hence, to the resolution of a failed (or weak) institution. Given its critical role in these proposed reforms, it is important to measure the extent to which market discipline already exists.

We study the extent of market discipline in the Canadian banking sector and also whether large banks enjoy a funding advantage over smaller banks. Canada provides a unique setting in which to examine market discipline since there have been no government bailouts in the history of the banking sector. Further, research has suggested that an implicit government guarantee has been in effect since the 1920s (e.g., Brean, Kryzanowski and Roberts, 2011). Our results show that, in Canada, large banks likely enjoy a funding advantage over smaller banks after controlling for various risk factors. A number of our findings support the notion that the market believes in an implicit government guarantee in the Canadian

banking sector. The findings also suggest that market discipline exists weakly in Canada. Debt holders respond to bank-specific risk factors, measured by ratios of equity capital, liquidity, performance, cost structure and business models, by adjusting the interest rate they require from banks or by withdrawing their funds. The results are robust to the introduction of added controls for the Big Six banks' funding and maturity mixes. It is important to note that not all of our results are consistent with a funding advantage for the Big Six banks. In particular, the Big Six banks do not necessarily pay less for wholesale deposits.

One might expect the funding advantage of large banks to increase, and market discipline to weaken, in the aftermath of the recent financial crisis as the market's perception that the government would step in if necessary was likely heightened. Future research will examine recent changes in large banks' funding advantage in Canada, and the extent to which market discipline has changed since the financial crisis.

The results of an examination of credit spreads in bond issues by the largest Canadian banks suggest that, unlike for subordinated bonds, the credit spreads for senior bonds are not significantly sensitive to bank-specific risk factors. Overall, our results generally support the argument that a bail-in mechanism can potentially enhance market discipline by engaging senior debt holders more effectively in the monitoring of large banks.

Our results have implications for how regulators could implement a bail-in. In particular, the current amount of subordinated debt for Canadian banks is unlikely to generate sufficient capital at the time of distress. Therefore, considering senior debt, as suggested under a bail-in mechanism, seems to provide a more effective resolution outcome.

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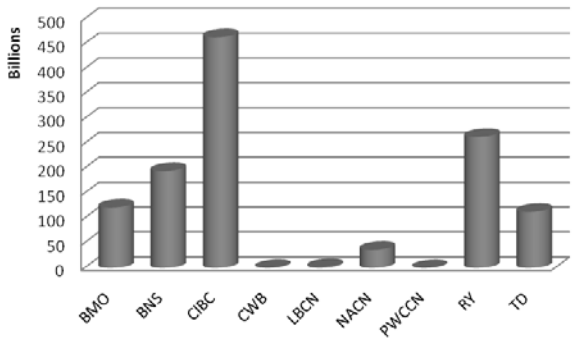
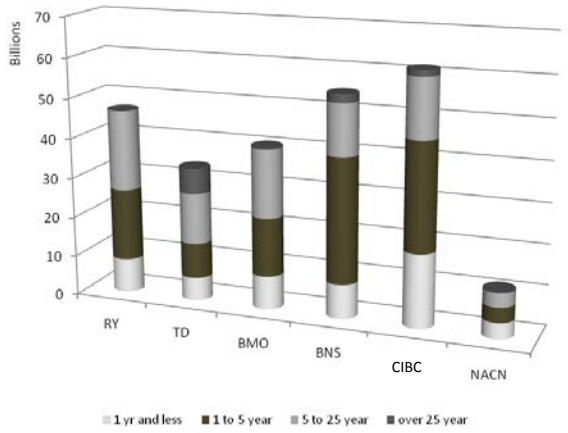
Figure 1- Total Amount of Bond Issuance by Selected Domestic Canadian Banks during the Sample Period (1990-2010). Amounts are presented in billions of Canadian dollars.

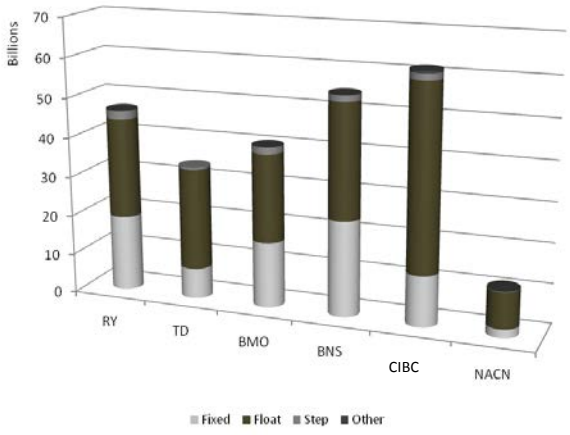
Panel A



Panel B



Panel C



Panel A represents the total amount of bonds issued by the nine largest Canadian banks. Issuance amounts are converted into Canadian dollars when bonds are issued in different currencies. Issue amounts are then deflated/inflated to 2005 base prices. Panels B and C, respectively, show the year-to-maturity distribution and the coupon-type distribution of all Canadian-dollar bond issuances by the so-called Big Six Canadian banks during the period 1990 to 2010. Banks are shown with their tickers in the figure. These banks include Bank of Montreal (BMO), Bank of Nova Scotia (BNS), Canadian Imperial Bank of Commerce (CIBC), Canadian Western Bank (CWB), Laurentian Bank of Canada (LBCN), National Bank of Canada (NACN), Pacific & Western Bank of Canada (PWCCN), Royal Bank of Canada (RY), and Toronto-Dominion Bank (TD). Caisse centrale Desjardins, another large Canadian bank, is deleted due to its different legal structure; it is the representative of the Desjardins Group, which itself is an association of credit unions. The source of data is Bloomberg and the period covers 1990-2010.

Figure 2- Capital Structure of Canadian Banks Based on Consolidated Balance Sheet, Quarter 4, 2010

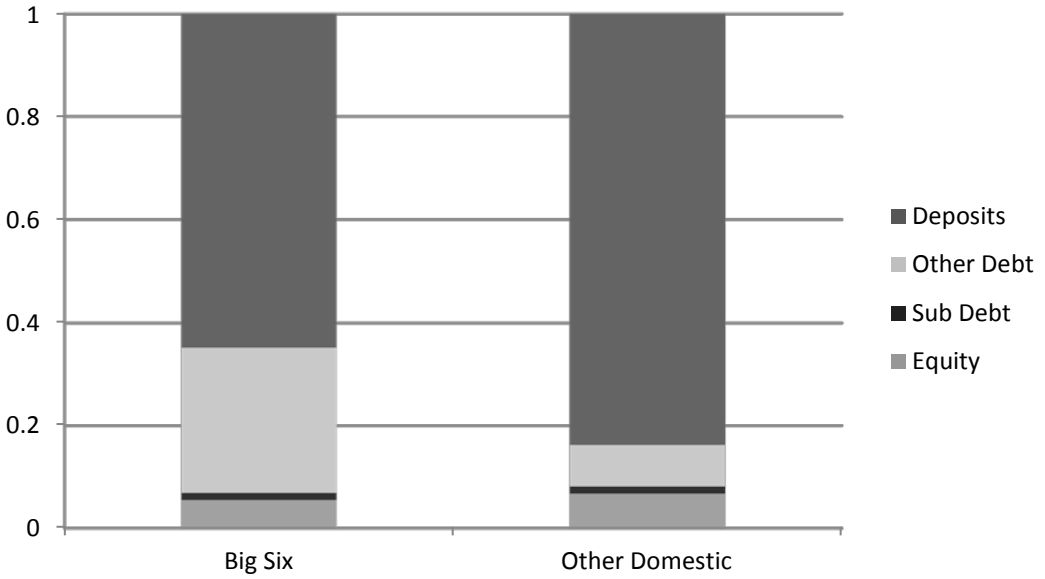
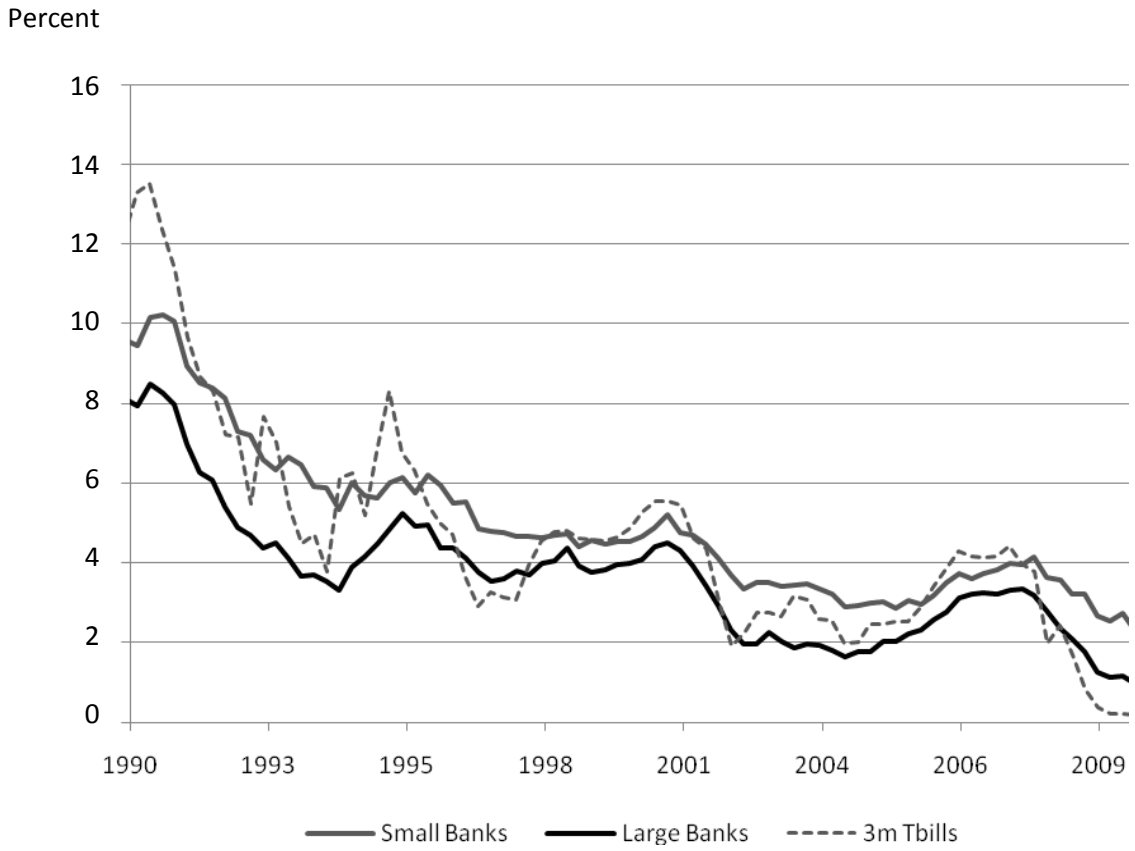


Figure 2 shows the average capital structure (liability and equity) of the Big Six and other Canadian banks at the end of 2010. 'Other domestic' banks include 15 banks. Banks' sources of funding are dominated by deposits. Smaller banks demonstrate a more traditional model of banking and rely more on deposit funding than the Big Six. Subordinated debt represents at most 2% of banks' source of funding. Other debt includes cheques and other items in transit, advances from the bank of Canada, acceptances, non-controlling interest in subsidiaries, and other liabilities. Sample includes all active banks in Canada as of 2010, excluding subsidiaries and foreign banks, trust and loan companies, and credit unions.

Figure 3- Quarterly Cost of Debt for Canadian Banks during the Period 1990-2010



For each group of Canadian banks (Big Six versus other domestic banks), the cost of debt is calculated as the median ratio of total interest expense during a quarter to the quarterly level of liabilities (also called implicit interest rate). Subsidiaries, foreign banks, loan and trust companies, and credit unions are excluded. This figure shows that the Big Six banks have a funding advantage in raising debt over other domestic banks (15 banks). Moreover, the cost of debt is highly correlated with government rates (represented by quarterly (3-month) government of Canada treasury rates). Data Source: Consolidated financial statements from Bank of Canada 1990-2010.

Table 1- Summary Statistics of all Debt Issues with Calculated Spreads by Top 11 Canadian Banks

		Subordinated Debt	Senior Unsecured Debt
Number of Observations		159	640
Credit Spread (%)	Mean	0.35	0.19
	Median	0.40	0.21
	Std Dev	0.53	0.57
Year to Maturity	Mean	10.7	4.9
	Median	10.0	5.0
	Std Dev	4.0	5.0
Issue Amount ($m)	Mean	206.0	129.4
	Median	100.0	20.0
	Std Dev	288.4	267.0

Table 1 provides summary statistics on bond issuances that are used in spreads analysis regressions. The sample is restricted to those that were issued in Canadian dollars by the six largest Canadian banks from 1990-2010.

Table 2- Explanatory Variables Used in the Regressions (ratios are in decimals)

Firm-Specific Variables:

- Equity (Ratio of Equity Capital to Total Assets)
- Performance (Return on Assets)
- Liquidity (Ratio of Liquid Assets to Total Assets)
- Overhead (the Ratio of Non-Interest Expenses to Total Assets)
- Non-Deposit Funding (the Ratio of Non-Deposit Funding to Total Assets)
- Log Asset (Natural Logarithm of Assets, Inflation-Adjusted)
- BIGSIX (a Dummy Variable that equals 1 if the issuer is one of the Big Six banks, 0 otherwise)
- Variance (Variance of Adjusted Stock Prices over the Previous Quarter)

Market-Specific Variables:

- VIX Index Level
- Return on TSX Index
- 3-Month Treasury Rates
- 10-Year Minus 2-Year T-Bill Yields
- Unemployment Rate

Deposit Characteristics (DN stands for Demand and Notice Deposits. FT stands for Fixed-term Deposits)

- DN-Municipal and school corporations
- DN-Deposit-taking institutions
- DN-Individuals
- DN-Other
- FT-Federal and provincial
- FT -Municipal and school corporations
- FT -Deposit-taking institutions
- FT -Individuals
- FT -Other
- Less than 1 year
- Between 1 and 5 years
- More than 5 years

Issue-Specific Characteristics:

- Coupon Rate
- Log Issue Amount (inflation adjusted)
- Redemption Feature (Call)
- Coupon Type (Fixed, Float)

Table 3a- Large Banks' Funding Advantage – Single-Equation Regression Results – Levels of Effective Interest Rates

	Interest on Liabilities		**Interest on deposits**		**Interest on wholesale deposits**		**Interest on subordinated debt**		**Real wholesale deposit growth**	
	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev
Equity	**-0.008**	0.003	**0.002**	0.004	**-0.008**	0.009	**-0.023**	0.017	**93.5**	76.5
ROA	**-0.012**	0.022	**0.003**	0.034	**0.097**	0.083	**-0.206****	0.083	**-396.9**	629.7
Liquidity	**-0.013*****	0.002	**-0.012*****	0.002	**-0.022*****	0.004	**0.043**	0.007	**71.5****	34.8
Overhead	**-0.056****	0.012	**-0.034****	0.014	**0.068***	0.034	**0.012*****	0.071	**69.6**	267.5
Non-Deposit Funding	**-3.00E-04**	0.002	**-0.007*****	0.002	**-0.001**	0.007	**0.010****	0.005	**-173.1*****	59.6
Unemployment Rate	**-0.002****	7.00E-04	**-0.002*****	0.001	**-0.003****	0.001	**-0.001**	0.002	**27.8**	11.9
Big Six	**-0.01**	5.00E-04	**-0.008*****	0.001	**-0.0006**	0.001	**-0.007*****	0.001	**31.6****	13.2
3 m T-Bill Rate	**0.002****	3.00E-04	**0.001*****	3.00E-04	**0.001****	6.00E-04	**0.001**	0.001	**2.6****	5.6
Intercept	**0.043*****	0.006	**0.049*****	0.006	**0.049*****	0.012	**0.051*****	0.013	**-217.1***	98.0
Year Fixed Effect	**Yes**		**Yes**		**Yes**		**Yes**		**Yes**	
Adjusted R Square	**80.40**		**82.88**		**55.86**		**50.23**		**1.11**	
No of observations	**987**		**947**		**885**		**804**		**942**	

* *significant at 10%*
** *significant at 5%*
*** *significant at 1%*

Table 3a reports the regression results on different proxies of the cost of debt and also a proxy for wholesale deposit growth across Canadian banks during the period 1990-2010. Coefficients for year-fixed effects are not reported. Interest on different types of debt (total liabilities, wholesale deposits, total deposits, or subordinated debt) is calculated as the ratio of interest expense on that type of debt divided by the level of that type reflected in quarterly financial statements. Real wholesale deposit growth is a proxy for the growth in uninsured deposits. Definitions for the dependent and explanatory variables can be found in Table 2.

Table 3b- Large Banks' Funding Advantage – Single-Equation Regression Results – Interacting Big Six Dummy and Risk Factors

	Interest on Liabilities		**Interest on deposits**		**Interest on wholesale deposits**		**Interest on subordinated debt**		**Real wholesale deposit growth**	
	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev
Equity	**-0.009*** **	0.003	**0.001**	0.004	**-0.032*** **	0.011	**-0.031** **	0.017	**293.80** **	95.61
ROA	**-0.009**	0.022	**0.012**	0.034	**0.078**	0.083	**-0.236*** **	0.085	**167.34**	654.08
Liquidity	**-0.012*** **	0.002	**-0.011*** **	0.002	**-0.022*** **	0.004	**0.026** **	0.011	**91.10** **	39.11
Overhead	**-0.062*** **	0.012	**-0.035*** **	0.014	**0.003***	0.037	**0.024**	0.073	**580.35** **	303.64
Non-Deposit Funding	**9.56E-04**	0.001	**-0.007*** **	0.002	**-0.031*** **	0.010	**0.011** **	0.005	**-390.12*** **	85.28
Unemployment Rate	**-0.001** **	7.70E-04	**-0.002*** **	0.001	**-0.003** **	0.001	**-0.001**	0.002	**28.00** **	11.85
Big Six	**-0.011*** **	0.004	**-0.011*** **	0.004	**-0.035*** **	0.001	**-0.018** **	0.007	**-8.52**	61.47
Equity * Big Six	**-0.187*** **	0.048	**-0.197*** **	0.045	**-0.374*** **	0.084	**0.170**	0.895	**97.98**	726.61
ROA* Big Six	**0.198**	0.330	**0.256**	0.289	**0.730**	0.483	**0.419**	0.512	**-2832.51**	4191.19
Liquidity* Big Six	**-0.012** **	0.005	**-0.010** **	0.005	**-0.016**	0.010	**0.030**	0.149	**-66.15**	85.47
Overhead* Big Six	**-0.782*** **	0.269	**-0.774*** **	0.259	**-0.128**	0.488	**0.061**	0.519	**-4455.17**	4202.91
NonDeposit * Big Six	**-0.020*** **	0.005	**-0.012*** **	0.006	**-0.070*** **	0.013	**-0.008**	0.011	**380.11*** **	112.44
3 m T-Bill Rate	**0.001*** **	3.54E-04	**0.001*** **	3.00E-04	**0.001** **	6.00E-04	**0.001**	0.001	**2.6** **	5.6
Intercept	**0.041*** **	0.006	**0.002**	0.004	**0.047*** **	0.011	**0.054*** **	0.013	**-215.54*** **	97.88
Year Fixed Effect	**Yes**		**Yes**		**Yes**		**Yes**		**Yes**	
Adjusted R Square	**80.92**		**83.33**		**57.61**		**50.57**		**2.13**	
No of observations	**987**		**947**		**885**		**804**		**942**	

* *significant at 10%*
** *significant at 5%*
*** *significant at 1%*

Table 3b reports the regression results on different proxies of the cost of debt and also a proxy for wholesale deposit growth across Canadian banks during the period 1990-2010. Coefficients for year-fixed effects are not reported. Interest on different types of debt (total liabilities, wholesale deposits, total deposits, or subordinated debt) is calculated as the ratio of interest expense on that type of debt divided by the level of that type reflected in quarterly financial statements. Real wholesale deposit growth is a proxy for the growth in uninsured deposits. Definitions for the dependent and explanatory variables can be found in Table 2.

Table 4- Large Banks' Funding Advantage – Single-Equation Robustness Tests with Quarterly Dummies – Levels of Effective Interest Rates

	Interest on Liabilities		**Interest on deposits**		**Interest on wholesale deposits**		**Interest on subordinated debt**		**Real wholesale deposit growth**	
	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev
Equity	**-0.007****	0.003	**0.002**	0.004	**-0.009**	0.010	**-0.022**	0.018	**87.4**	78.1
ROA	**-0.011**	0.022	**0.010**	0.034	**0.099**	0.086	**-0.209****	0.088	**-374.2**	651.4
Liquidity	**-0.013*****	0.002	**-0.012*****	0.002	**-0.022*****	0.004	**0.045*****	0.008	**72.8****	35.5
Overhead	**-0.058*****	0.012	**-0.035****	0.014	**0.068***	0.036	**0.006**	0.074	**76.7**	274.5
Non-Deposit Funding	**-2.71E-04**	0.002	**-0.007*****	0.002	**1.18E-04**	0.007	**0.011****	0.005	**-173.9*****	61.1
Big Six	**-0.010*****	0.001	**-0.008*****	0.001	**-0.001**	0.002	**-0.007*****	0.001	**31.5****	13.4
Intercept	**0.030*****	0.001	**0.031*****	0.001	**0.024*****	0.003	**0.046*****	0.004	**7.8**	23.2
Quarter Fixed Effect	**Yes**		**Yes**		**Yes**		**Yes**		**Yes**	
Adjusted R Square	**80.53**		**83.65**		**54.20**		**47.87**		**1.73**	
No of observations	**987**		**947**		**885**		**804**		**942**	

* *significant at 10%*
** *significant at 5%*
*** *significant at 1%*

Table 4 reports the regression results on different proxies of the cost of debt and also a proxy for wholesale deposit growth across Canadian banks during the period 1990-2010. Quarterly dummies are used as substitutes for market risk factors and year fixed effects. The coefficients for Quarter fixed effects are not reported. Interest on different types of debt (total liabilities, wholesale deposits, total deposits, or subordinated debt) is calculated as the ratio of interest expense on that type of debt divided by the level of that type reflected in quarterly financial statements. Real wholesale deposit growth is a proxy for the growth in uninsured deposits. Definitions for the dependent and explanatory variables can be found in Table 2.

Table 5- Two-Stage Tests of the Impact of Funding and Maturity Mix on Interest on Deposits

Panel 1 – First Stage	**Interest on deposits (1)**		**Interest on deposits (2)**	
	Estimate (x10E-3)	Std Dev	Estimate	Std Dev
DN-Municipal and school corporations	**-1.213*** **	1E-4		
DN-Deposit-taking institutions	**-1.102** **	1E-4		
DN-Individuals	**-1.021** **	1E-4		
DN-Other	**-1.118*** **	1E-4		
FT-Federal and provincial	**3.049*** **	3E-4		
FT -Municipal and school corporations	**9.173*** **	9E-4		
FT -Deposit-taking institutions	**-0.778***	1E-4		
FT -Individuals	**-0.849** **	1E-4		
FT -Other	**-0.966** **	1E-4		
Less than 1 year			**2E-4*** **	3E-5
Between 1 and 5 year			**7E-5***	4E-5
More than 5 year			**-0.005***	5E-4
Intercept	**129.484*** **	0.042	**0.025*** **	0.003
R Square	**22.31**		**23.60**	
No of observations	**952**		**448**	

Panel 2 –Second Stage	**Residual of interest on deposits (1)**		**Residual of interest on deposits (2)**	
	Estimate	Std Dev	Estimate	Std Dev
Equity	**-0.014***	0.004	**-0.218*****	0.033
ROA	**0.052**	0.038	**-0.139**	0.204
Liquidity	**0.002**	0.002	**-0.023*****	0.004
Overhead	**0.088*****	0.016	**-0.407****	0.205
Non-Deposit Funding	**-0.010*****	0.002	**-0.008**	0.006
Unemployment Rate	**-0.025*****	8E-4	**9E-5**	0.001
Big Six	**-0.003*****	6E-4	**-0.002****	0.001
3 m T-Bill Rate	**0.001*****	4E-4	**0.004*****	6E-4
Intercept	**-0.013***	0.007	**0.012**	0.009
Year Fixed Effect	**Yes**		**Yes**	
Adjusted R Square	**72.85**		**77.18**	
No of observations	**946**		**447**	

* *significant at 10%*
** *significant at 5%*
*** *significant at 1%*

Table 5 reports two-stage analyses of cost of deposit. In the first stage (Panel 1), the cost of deposit for each quarter-bank is regressed on percentage of each deposit component at the beginning of the period. Model (1) and Model (2), respectively, estimate interest on deposit in terms of funding mix and maturity mix. Deposits are reported in two main categories: Demand and notice deposits, denoted by DN and Fixed-term deposits denoted by FT in the table. Each of these categories has 5 subcategories. Subcategory DN-Federal and provincial is dropped to prevent multicollinearity of including independent variables, the sum of which is 100%. In Model (2), deposits are categorized into four groups based on their maturity: less than 1 year, between 1 and 5 years, more than 5 years and also other. The latter group includes interest insensitive deposit or floating rate and is not included as a dependent variable to prevent multicollinearity. All independent variables in Panel 1 are in percentage format. Panel 2 reports the results of the second-stage regression, where the dependent variable is the residual from Panel 1. The funding mix is available for the sample period (1990-2010); however, the maturity mix is only available from 1997 to 2010 for nine banks.

Table 6 - Large Banks' Funding Advantage – Single-Equation Regression Results – Changes in Effective Interest Rates

	Change in Interest on Liabilities		**Change in Interest on deposits**		**Change in Interest on wholesale deposits**		**Change in Interest on subordinated debt**	
	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev	Estimate	Std Dev
ΔEquity	**-0.229*** **	0.020	**-0.129*** **	0.034	**-0.045**	0.093	**-0.067**	0.048
ΔROA	**-0.001**	0.033	**-0.001**	4.00E-04	**-0.001**	0.001	**8.00E-5**	0.001
ΔLiquidity	**-1.00E-04**	2.00E-04	**-2.00E-4**	-2.00E-4	**2.00E-5**	6.00E-4	**0.003**	0.006
ΔOverhead	**0.004***	0.002	**-0.003**	0.002	**0.005**	0.006	**-0.032**	0.033
ΔNon-Deposit Funding	**-0.124*** **	0.033	**-0.171*** **	0.030	**-0.365*** **	0.089	**0.060**	0.040
ΔUnemployment Rate	**-0.404***	0.146	**-0.030**	0.132	**0.005**	0.340	**-0.046**	0.128
Big Six	**-0.017***	0.009	**-0.013**	0.008	**-0.061*** **	0.023	**-0.006**	0.009
Δ3 m T-Bill Rate	**0.075*** **	0.025	**0.056** **	0.023	**0.207*** **	0.011	**0.063*** **	0.004
ΔIntercept	**-0.048** **	0.020	**0.049*** **	0.006	**-0.072***	0.043	**-0.035***	0.017
Adjusted R Square	**15.41**		**15.39**		**44.16**		**27.48**	
No of observations	**967**		**926**		**865**		**784**	

* *significant at 10%*
** *significant at 5%*
*** *significant at 1%*

Table 6 reports the first-difference regression results on different proxies of the cost of debt across Canadian banks during the period 1990-2010. Coefficients for year-fixed effects are not reported. Interest on different types of debt (total liabilities, wholesale deposits, total deposits, or subordinated debt) is calculated as the ratio of interest expense for that type of debt divided by the level of that type reflected in quarterly financial statements. A change in variable X_t (also represented by ΔX_t) is defined as (X_t/X_{t-1})-1. Definitions for the dependent and explanatory variables can be found in Table 2.

Table 7 - Market Discipline in Big Six Banks' Bond Issuance – Regression Results

	Subordinated Debt		**Senior Unsecured Debt**	
	Estimate	Std Dev	Estimate	Std Dev
Bank Characteristics				
Log(asset)	**-1.323***	0.728	**-0.270**	0.218
Equity	**-42.679***	22.20	**-6.922**	8.358
ROA	**50.879**	105.2	**18.236**	29.118
Liquidity	**-1.602**	2.855	**-0.203**	1.184
Ratio of Non-Deposit Funding	**0.611**	2.750	**-0.792**	1.008
Overhead	**27.156**	94.68	**-2.555**	29.841
Variance	**-0.004**	0.023	**0.004**	0.005
Bond Characteristics/Liquidity				
Fixed	**0.177**	0.123	**0.216*****	0.047
Coupon Rate	**0.119****	0.058	**0.055*****	0.013
Log(Issue Amount)	**-0.040**	0.036	**0.018**	0.014
Callable	**0.563*****	0.172	**0.316**	0.051
Time to Maturity (Year)	**-0.006**	0.012	**0.010***	0.006
Coupon Frequency (Per Year)	**0.003**	0.013	**-0.018*****	0.005
Market Conditions				
10 yr minus 2 yr Treasury Rates	**-0.030**	0.206	**-0.026**	0.080
3-month Treasury Rates	**0.013**	0.103	**0.146*****	0.047
Unemployment Rate	**0.053**	0.246	**-0.121**	0.098
Average VIX Index	**0.003**	0.019	**0.014*****	0.004
Return on TSX Index	**0.768**	1.097	**-0.461**	0.325
Year Fixed Effect	**Yes**		**Yes**	
Bank Fixed Effect	**Yes**		**Yes**	
Intercept	**28.584****	14.212	**6.745**	4.473
Number of Observations	**133**		**554**	
Adjusted R Square	**24.84**		**59.71**	

* *significant at 10%*
** *significant at 5%*
*** *significant at 1%*

In Table 7, credit spreads of all issues in Canadian dollars by Canadian banks are regressed on bank-specific risk factors, bond/liquidity specific characteristics and market-specific factors. Regressions are controlled for year- and issuer-fixed effects. For a list of dependent and explanatory variable definitions, see Table 2.

Table 8 - Market Discipline – Large versus Small Banks – Single-Equation Tests

	Interest on Liabilities Big Six Banks		**Interest on Liabilities Other Banks**	
	Estimate	Std Dev	Estimate	Std Dev
Equity	**-0.114**	0.067	**-0.026****	0.009
ROA	**-0.372**	0.249	**0.039**	0.046
Liquidity	**-0.015***	0.007	**-0.011***	0.005
Overhead	**-1.164**	0.857	**-0.065*****	0.022
Non-Deposit Funding	**-0.018****	0.005	**0.004**	0.005
Log (assets)	**0.001**	5E-4	**-0.001*****	4E-4
Intercept	**0.025***	0.011	**0.051*****	0.007
Bank Fixed Effect	**Yes**		**Yes**	
Quarter Fixed Effect	**Yes**		**Yes**	
Adjusted R Square	**94.33**		**78.02**	
No of observations	**480**		**507**	

* *significant at 10%*
** *significant at 5%*
*** *significant at 1%*

Table 8 reports the results of estimating interest on total liabilities separately for the Big Six banks and other banks in Canada during the period 1990-2010. The structure of regressions is similar to the ones in Table 5. However, log (asset) as a measure of bank size and bank fixed effects are also considered in this table. Definitions for the dependent and explanatory variables can be found in Table 2.