

# **Learning Lessons from the Crisis: Relative Risk of Canadian Compared to American Banks**

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## ***Abstract***

*This paper examines whether, as is commonly believed, the risk of Canadian banks is lower than that of American banks for the 2002-2007 period leading up to the financial crisis. A comparison of American and Canadian banking risk is of particular interest since the two countries are so similar with strong linkages of the two countries' economies under the North American Free Trade Agreement, yet apparently have had markedly different levels of risk in their financial systems in recent years given the large number of American bank failures during the financial crisis compared to their complete absence in Canada. The importance of a better understanding of the relative levels of risk of various nationalities of banks and regulatory regimes has become increasingly apparent as the costs of taxpayer-funded responses to the international credit crisis, which has led to a worldwide recession, have skyrocketed. My main finding is that the risk of Canadian banks is, in fact, higher. This finding persists when banks are compared on a size-matched basis.*

*Keywords: Financial Institution, Financial Market, Financial Service  
JEL codes: G21, G01*

## **1. Introduction**

This study investigates whether Canadian banks are less risky than American banks. While the much larger number of bank failures in the US, and a small number of studies indicate that this is true, there is little empirical research supporting that hypothesis, particularly for banks which are not publicly traded. Notwithstanding the lack of evidence, the popular press has usually taken it as obvious that Canadian bankers are more conservative, although the exact reason for being so is not clear. The Globe and Mail (Scofield, 2009) has written that the “Canadian banking sector has also gained international recognition for its ingrained conservatism” but gives no evidence to support this assertion beyond the fact that there have been no Canadian bank failures in recent years and government bailouts have not been required to date to combat the effects of the credit crisis, unlike in the U.S. One of the few empirical studies looking at the relative risk of Canadian and American banks did find Canadian banks to be less risky than American ones, but that study included only publicly-traded financial institutions, since the measure of risk used was the standard deviation of daily stock returns (Fisher et al, 2002). As a result, only six Canadian institutions and thirty-six American institutions were included in the sample. A Bank of Canada study, although not assessing risk relative to US banks, also found that the Canadian banks posed “very low insolvency risk” (Liu et al, 2004). The data set on

which this conclusion was based also included only six publicly-traded banks. In contrast, this study includes 35 Canadian financial institutions and 5,259 American ones.

It is somewhat surprising that material differences in risk levels between Canadian and American banks could exist given the similarity and interconnectedness of the two countries' economies, and especially financial systems, under the North America Free Trade Agreement. The major Canadian banks also have significant American businesses that are typically closely integrated with the parent bank, which could also be seen to make substantial differences in risk levels of banks in the two countries, if they do exist, difficult to explain. The question of whether Canadian banks are less risky than American ones is therefore worthy of study. A better understanding of risk levels of banks is taking on greater importance as policy-makers and regulators are forced to devise increasingly costly measures to bail out banks as the credit crisis reverberates internationally.

## 2. Background

The primary risk measure utilized in this study is what is known as the risk index. This measure has been commonly used in the literature (e.g. Hannan and Hanweck (1988), Sinkey and Nash (1993), Boyd et al (1993), Kwan and Laderman (1999), and Beck and Laeven, (2006)) and is defined as:

$$\text{Risk Index} = \frac{\left(\frac{\Pi}{A} + \frac{K}{A}\right)}{\sigma_{\Pi/A}}$$

where  $\Pi$  is net income,  $A$  is total assets and  $K$  is total regulatory capital held by the bank. Returns in this study will be measured relative to total assets rather than relative to equity to eliminate the impact of leverage, which for banks can be very substantial. Further, they are a direct measure of management's ability to generate returns on a portfolio of assets (Rivard and Thomas, 1997). The asset measure includes both on and off-balance sheet assets.

The higher the risk index, the greater is the equity capital and average level of returns available to cushion against a loss relative to volatility of returns. This means the probability of failure is lower. The risk index has the advantage of combining in a single measure profitability, leverage, and return volatility. It increases when profitability and the capital held by the bank relative to assets go up and decreases when profit volatility increases. In this research, both the measure itself and its underlying components are analyzed.

Hannan and Hanweck (1988) explained their derivation of the risk index by pointing out that insolvency for banks occurs when current losses exhaust capital or, equivalently, when the return on assets is less than the negative capital-asset ratio. They go on to show that the probability of insolvency is:

$$p \leq (1/2) \frac{\sigma^2}{\left(\mathbb{E}\left[\frac{\Pi}{A}\right] + \frac{K}{A}\right)^2} \quad (1)$$

The  $\frac{1}{2}$  in this inequality accounts for the fact that failure occurs only in one tail of the distribution. If profits follow a normal distribution then the risk index is the inverse of the probability of insolvency. It measures the number of standard deviations that a bank's return on assets has to drop before equity is wiped out (Beck and Laeven, 2006). Because of this relationship, the risk index has sometimes been referred to as the probability of failure (see, for example, Kwan and Laderman, 1999).

Even if returns on assets are not normally distributed, the risk index is still useful for relative comparisons (Boyd and Gertler, 1994). It likely underestimates the true probability of bankruptcy since, by definition, it assumes failure only if one-period losses exceed a bank's total capital. Realistically though, banks experiencing losses of a much smaller scale could experience liquidity problems, creditor runs and regulatory interventions (Boyd and Graham, 1986).

While the risk index has its advantages shortcomings must also be noted. First, it measures risk in a single period of time and therefore does not take into account that higher levels of risk resulting from a sequence of losses over more than one period. It also relies on the accuracy of accounting data which may not be a well-founded assumption since the literature indicates that banks tend to smooth earnings (Beck and Laeven, 2006). Notwithstanding these concerns, the risk index still can be a useful measure of relative risk between groups of banks at a point in time.

The risk index has been widely and regularly used as a proxy for risk in the financial and non-financial literature since Roy (1952). It has commonly been referred to as the distance-to-default and the z-score, but differs from Altman's (1968) z-score which is a predictor of corporate financial distress based on accounting ratios. Studies utilizing the risk index include: Boyd and Graham (1986) who looked at the relationship between risk and the degree of involvement in non-bank activities; Hannan and Hanweck (1988) who investigated whether there was, as they expected, a positive relationship between bank risk-taking and the spreads over the default free rate and Kimball (1997) who compared banks specializing in small business micro-loans with a mixed peer group matched by size and location and found that the focused group was riskier than the diversified group.

### **3. Data and Method**

For each quarter-end for the period from December 31, 2001 to December 31, 2007 three different data values were obtained for each Canadian and American bank: net income for that quarter, average risk-weighted assets and total risk-based capital ratio. Return on assets was defined as annualized net income after taxes and extraordinary items for the quarter as a percent of average total risk-weighted assets during the quarter. It includes extraordinary items and other adjustments, net of taxes. Risk-weighted assets are assets adjusted for risk-based capital definitions which include on-balance-sheet as well as off-balance-sheet items multiplied by risk-weights that range from zero to one hundred percent. A conversion factor is used to assign a balance sheet equivalent amount for selected off-balance-sheet accounts. The risk-weights and conversion factors are those stipulated by the Bank for International Settlements, and used by regulators in major industrialized countries. Quarterly returns on risk-weighted assets and the total risk-based capital ratios were calculated as the mean of the quarterly observations during the twenty-four quarter study period for each bank. Similarly, the standard deviation of return on

assets was based on the quarterly observations of returns during the twenty-four quarter study period for each bank and the mean of the observation as discussed above.

The hypothesis that Canadian banks are less risky than American ones was tested using the non-parametric Mann-Whitney *U* Test, as in Kwan (2004). Tests were done on the full sample of banks and on the thirty-five Canadian banks matched with a sub-sample of the thirty-five American banks closest in size to them since, as described below, the literature indicates that size may be correlated with risk and that the Canadian banks, on average are much larger than the American banks. Separate comparisons were also done on the thirteen very large banks with over \$100 billion in average assets and on all banks except for those thirteen very large banks.

The Mann-Whitney *U* Test, although originally proposed only for comparisons of samples of equal sizes, was extended to arbitrary sample sizes by Mann and Whitney (1947). The Mann-Whitney *U* Test assumes independent samples, continuous or discrete random variables, and similar distributional shapes including equal variances (Sheskin, 2004). There is no evident reason to believe that there is dependence between the samples in this research, and inspection of the data and boxplots did not reveal dissimilar distributional shapes. A Levene test of equal variances was carried out, and while the hypothesis of equal variances could not be rejected for return on assets, standard deviation of return on assets, and the assets to capital ratio, it was rejected for the risk index. The risk index in log units could not be rejected though, and accordingly this measure was used instead of the raw risk index for the statistical tests described below.

The banks included in this study vary widely in size with the Canadian banks, although much fewer in number, being much larger, on average, when measured by average assets over the period. This is important because there are theoretical reasons and empirical support for both positive and negative relationships between size and bank risk. On one hand increased size may mean banks can more readily benefit from diversification and from economies of scale for risk management and other areas that may be related to risk levels such as more sophisticated information systems and more advanced internal audit functions. Conversely, increasing size can lead to increased risk because of moral hazard incentives and agency problems associated with managing a larger and more complex organization (Elyasiani et al, 2007). Large banks may also perceive themselves, and be perceived by others to be “too big to fail” because of their systemic importance and expect to be bailed out by governments if they run into trouble; therefore they may take on excessive levels of risk. The effect is amplified by the existence of deposit insurance if premium payments do not accurately reflect the underlying risk which is the case in the US and in most other countries due to the difficulties involved in pricing deposit insurance. This means that while gains from growth or pursuing risky strategies go to bank shareholders, losses are borne by the government through the deposit insurer. Boyd and Graham (1986) described the payoff facing shareholders of banks with deposit insurance as “Heads we win, tails, the FDIC loses”.

Other, but fewer, researchers have reported some evidence that size and risk are positively related. De Nicolo et al, (2004) found that large financial conglomerates exhibited a higher level of risk in 2000 than their smaller counterparts; this trend was not apparent in 1995. They attributed the 2000 result to moral-hazard incentives outweighing the potential risk-reducing impacts of economies of scale and scope and through geographic and product diversification possibilities. In 2000 the larger financial firms had both higher levels of assets

relative to capital and larger standard deviations of returns on assets. Results were the same for sub-samples of banks from the US, Japan and Western Europe.

Boyd and Graham (1996) also found that larger banks are riskier than smaller ones. When failure was broadly defined as including those banks which are in receipt of government funds in any form of bailout the large American bank failure rate was much higher in both 1971 to 1978 and 1979 to 1986 while small banks failed more commonly from 1987 to 1994. In the overall period of 1971 to 1994, though, the large bank cumulative failure rate was also higher at 17% compared to 12% for the smaller banks. The authors theorized that the too big to fail doctrine may play a role in explaining these findings.

Other studies contradict the importance of the too big to fail factor. Benston et al (1995) theorized that mergers may be driven by the desire to diversify earnings in an attempt to generate higher levels of cash flow relative to risk rather than trying to become too big to fail. Their study based on 302 mergers between December 1981 and July 1986 found support for this hypothesis in a negative relationship between the purchase premium and the target's contribution to the risk of the merged entity. This contradicted the alternative hypothesis of a positive relationship if the motivation was to increase risk and thus return to take advantage of the deposit insurance subsidy and/or to make the merged entity too big or important to fail.

It appears possible, therefore, that size is a confounding variable in the relationship between various factors and risk and may also be related to the other component ratios of the risk index. Overall the literature is not unanimous but leans towards larger banks being less risky because of higher profits and lower variability in those profits but holding lower capital levels. Accordingly size was controlled for in certain statistical comparison in this study.

Data for the study were obtained for American banks through the Statistics on Depository Institutions website of the Federal Deposit Insurance Corporation at [www2.fdic.gov/sdi/index.asp](http://www2.fdic.gov/sdi/index.asp). Data for the Canadian banks was obtained from the website of the Office of the Superintendent of Financial Institutions at [www](http://www). Information covers quarters ending from December 31, 2001 to December 31, 2007. An advantage of this twenty-four quarter time period is that the findings should not be driven by cyclical events since it includes both an economic contraction from March to November 2001 and then a subsequent expansion (Hall et al, 2003).

In this paper the term bank is used to refer to any deposit-taking institution. Certain of these, such as savings and loan associations and thrifts in the US and trust and loan companies in Canada, are not legally banks but carry out essentially the same functions of taking deposits and giving out loans and therefore are included in the data set.

Following Sinkey and Nash (1993), banks were tested to identify those where the negative return on assets was more than twice the risk-based capital ratio. In that earlier study, these banks were eliminated because it was feared that inclusion of such banks might distort certain aggregate financial ratios since they were in severe economic distress. In this data set no such banks existed. To avoid the impact of failures and new bank start-ups on data consistency, only banks that had information available for all quarters in the observation period were included in this study. Banks organized as tax-free S-Corporations under the American tax code were eliminated since they are not comparable to their taxable Canadian counterparts. After the 2,409

banks of this type were eliminated 5,259 American banks remained. This compares to only 35 Canadian banks that existed during the study period, even when trust and loan companies were included.

#### 4. Results

The major hypothesis is that total risk, as proxied for by the mean log of the risk index, is lower for the Canadian banks than for the American banks. Recall that a higher risk index score means lower risk. The primary hypothesis was strongly contradicted for the full sample of banks and with the size-matched sample:

Table 1: Results for Full Sample of Banks

American Banks		Canadian Banks		
Number of Banks	Log Risk Index	Number of Banks	Log Risk Index	P-Value
5,259	1.7161	35	1.2705	<0.0005

Source: Author's calculations

Table 2: Results for Size-Matched Sample

American Banks		Canadian Banks		
Number of Banks	Log Risk Index	Number of Banks	Log Risk Index	P-Value
35	1.7484	35	1.2705	<0.0005

Source: Author's calculations

The sub-components of the risk index- return on assets, standard deviation of return on assets and the capital to assets ratio- were also compared to better understand the underlying drivers of the aggregate risk level.

Table 3: Sub-Component Results for Full Sample

	American Banks (n=5,259)	Canadian Banks (n=35)	P-Value
Mean Return on Assets	2.03	2.6175	0.572
Mean Standard Deviation of Return on Assets	1.3831	2.5108	<0.0005
Mean Capital to Assets Ratio	21.33	21.79	0.944

Source: Author's calculations

Table 4: Sub-Component Results for Size-Matched Sample

	American Banks (n=35)	Canadian Banks (n=35)	P-Value
Mean Return on Assets	2.03	2.6175	0.572
Mean Standard Deviation of Return on Assets	1.3831	2.5108	<0.0005
Mean Capital to Assets Ratio	21.33	21.79	0.944

Source: Author's calculations

The data indicates that while there is no statistically significant difference between the return on assets and the capital to assets ratio between the American and Canadian banks, there is a very significant difference between the standard deviation of the returns on assets for banks in the two countries.

The Canadian banking industry is dominated by five major banks that are much larger than their competitors. Even the smallest of the five, Bank of Montreal, is more than three times larger in terms of assets than the sixth largest bank, National Bank of Canada:

Table 5: Canadian Banks Ranked by Mean Assets 2001 to 2007 (000's)

Royal Bank of Canada	457,056,123
Toronto-Dominion Bank (The)	344,379,993
Bank of Nova Scotia (The)	323,467,751
Canadian Imperial Bank of Commerce	294,351,877
Bank of Montreal	289,023,088
National Bank of Canada	95,523,921
HSBC Bank Canada	46,191,995
Laurentian Bank of Canada	17,449,678
ING Bank of Canada	16,517,683
Citibank Canada	14,175,292
Canadian Western Bank	5,486,922
Manulife Bank of Canada	4,812,649
BNP Paribas (Canada)	4,510,059
Home Trust Company	2,724,008
Equitable Trust Company (The)	1,757,596
AGF Trust Company	1,573,487
Citizens Bank of Canada	1,543,400

Pacific & Western Bank of Canada	971,974
UBS Bank (Canada)	961,867
Peoples Trust Company	728,143
Korea Exchange Bank of Canada	588,115
Peace Hills Trust Company	452,200
MCAN Mortgage Corporation	405,062
Bank of East Asia (Canada) (The)	391,169
Bank of China (Canada)	283,957
Mega International Commercial Bank (Canada)	275,232
State Bank of India (Canada)	264,194
ResMor Trust Company	231,870
Presidents Choice Bank	225,356
Computershare Trust Company of Canada	164,911
CTC Bank of Canada	130,276
CS Alterna Bank	94,373
First Data Loan Company, Canada	80,796
Household Trust Company	70,110
Habib Canadian Bank	58,651

Source: Author's calculations

In order to test whether it is the presence of these very large banks with over \$100 billion in assets, which comprise over 14% of the Canadian banks but less than 1% of the US banks, which is the driver of these the results, a further comparison was carried out on all banks except for the banks with over \$100 billion in assets. This meant that the five largest Canadian banks and the eight largest American banks were excluded from this test. Once again the American banks exhibited a higher risk index score, indicating lower levels of risk, than the Canadian banks.

Table 6: Results for Banks With Less Than \$100 Billion in Assets

American Banks		Canadian Banks		
Number of Banks	Log Risk Index	Number of Banks	Log Risk Index	P-Value
5,251	1.7159	30	1.2616	<0.0005

Source: Author's calculations

The five largest Canadian banks were also riskier than the eight largest American banks with more than \$100 billion in assets although the difference was not significant at the 5% confidence level as the p-value was 0.107.

Table 7: Results for Banks With More Than \$100 Billion in Assets

American Banks	Canadian Banks
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Number of Banks	Log Risk Index	Number of Banks	Log Risk Index	P-Value
8	1.8347	5	1.3240	0.107

Source: Author's calculations

## 5. Conclusion

It has been hypothesized here that Canadian banks are less risky than American banks. This is based on evidence such as the much larger number of bank failures in the US in recent years, where two banks went under in 2009, twenty-four in 2008 and three in 2007 (FDIC, 2009). In contrast, not a single Canadian financial institution has failed since 1996 (CDIC, 2009). This research, though, indicates that Canadian banks are, in fact, riskier than American ones, at least during the 2002 to 2007 period and the finding appears robust to different sizes of banks.

The conclusion of this paper is based on an accounting measure, the risk index, and further validation of that measure, and its efficacy as a proxy for bank risk, is an obvious avenue for future research. This could be done through comparison to risk as measured by other methods such as an implied volatility approach or with any or all of examiner or bond rating agency scores, credit default swap premiums, bank subordinated debt spreads relative to risk-free bonds or eventual failure since the implicit assumption is that risky banks are more likely to fail.

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