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Is the Canadian Banking System Really "Stronger" than the U.S. One?

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***A*bstract:** The Canadian banking system is considered one of the "best" in the world (Bordo *et al.*, 2011). To examine this issue, this paper compares the risk-return trade-off of Canadian and U.S. banks in the context of market-based banking. It is found that non-interest income is actually more volatile in Canada, essentially because Canadian banks are more involved in trading and capital markets business lines than their U.S. peers. Even though U.S. banks are more exposed to securitization, which contributes to increasing bank risk (Calomiris and Mason, 2004), the analysis here does not conclude that the Canadian banking system is performing significantly better. On one hand, Canadian banks do better in downturns; on the other hand however, depending on the statistics, U.S. banks tend to benefit more from the transition to market-based banking.

JEL Classifications: C32, G20, G21

Keywords: Bank performance; Market-oriented banking; Securitization; Non-interest income; Financial stability

1. Introduction

The Canadian banking system has the reputation of being one of the most robust systems in the world (Ratnovski, and Huang, 2009; Bordo *et al.*, 2011)[1]. Many arguments are proposed to justify this relative performance. One that is often invoked is the more efficient regulation of banks. For example, the Office of the Superintendent of Financial Institutions (OSFI) has imposed leverage constraints to Canadian banks well before the Basel I Agreement, and the rules regarding bank capital keep banks' probability of default low (Liu *et al.*, 2006). Second, in terms of risk-weighted assets, regulatory capital ratios are higher in Canada than in many industrialized countries, which

[1] In his speech delivered at the University of Alberta on May 1st 2013, Mark Carney, Governor of the Bank of Canada, argued that the Canadian financial system is one of the strongest—if not the strongest—in the world.

ought to deliver a more robust system[2]. Furthermore, Canadian banks seem to have access to relatively more stable sources of funding and hold more liquid assets so they can absorb liquidity shocks more easily. Fourth, the Canadian banking system is very concentrated in comparison to the U.S one (Ratnovski and Huang, 2009). This is another factor that might help explain why Canadian banks could better resist to adverse shocks (Allen and Gale, 2004; Bordo, 2011). Finally, Canadian banks might also manage their non-traditional activities with lower costs—i.e., more efficiently (Smith, 1999; Liu *et al.*, 2006; Jason and Liu, 2007; Clark and Siems, 2002).

All these arguments focus on the robustness of the banking system and do not really consider its performance, as if these two dimensions could be examined separately. This study is a first attempt to fill this gap. Our primary motivation is to compare the relative performance of the Canadian and U.S. banking systems in terms of risk-return trade-off, taking explicitly into account the transition of both systems toward market-based banking. Since bank non-traditional, off-balance-sheet activities are considered riskier than the traditional business lines (e.g., Stiroh and Rumble, 2006; Calmès and Théoret, 2010), investigating the impact of the change in banks' product mix on the risk-return trade-off provides a natural experiment to gauge the relative merits of each banking system.

The intuition behind our main argument is that profits are essential to build a strong equity basis, and obviously the most effective way to privately avoid banking fragility. In this respect, depending on the statistics, U.S. banks actually appear to be more profitable than Canadian ones in most periods. Furthermore, monitoring the historical comovements between bank accounting returns and their key determinants reveals that banks' financial results display a greater average volatility in Canada than in the U.S. We attribute this seemingly paradoxical result to the greater average volatility of the Canadian banks' product-mix—based more on securities markets—and to a larger financial leverage. Even if Canadian banks display a slight advantage in terms of loan loss provisions, suggesting less risky loans, and a clear advantage in terms of non-interest expenses (likely attributable to their product mix and their lower net interest rate margin), our results suggest that the performance of the Canadian banking system is not as impressive as previously thought.

This paper is organized as follows. Section 2 discusses our Canadian and U.S. datasets and compares the relative structure of the two banking systems. Section 3 examines the transition of the U.S. and Canadian banking systems from traditional towards market-based business lines. Section 4 provides our model estimations of the performance of the two banking systems. Section 5 focuses on the volatility of Canadian and U.S. banks' financial results and Section 6 concludes.

2. Data

2.1 The U.S. and Canadian Samples

Our dataset is annual and runs from 1986 to 2009—i.e., until the end of the subprime crisis. The Canadian database includes the eight domestic banks, which control more than 90% of total banks' assets. Data come from the Canadian Bankers Association, the Bank of Canada, Statistics Canada and the Office of the Superintendent of Financial Institutions. The U.S. database is drawn from the Federal Deposit Insurance Corporation (FDIC), and from the *Federal Reserve Bulletin* series of reports on "the profits and balance sheet developments at U.S. commercial banks". In addition to the aggregate of all banks, we also sample U.S. banks by size. Big banks are the 10

[2] Bank of Canada, Financial System Review, June 2009. Note that this argument does not hold for broad measures of leverage. As discussed later, the asset to equity ratio is much higher for Canadian than U.S. banks. See also Calmès and Théoret (2012).

largest U.S. banks in terms of assets, while medium banks are the 11 to 100 largest banks. Small banks are the ones not ranked among the 1000 largest by assets. Note that each of the 5 Canadian biggest banks holds larger assets than the fifth-U.S. bank. At the end of 2011, the total assets of the 8 Canadian domestic banks amount to $3.03 trillion while those of the top 10 U.S. banks amount to $7.16 trillion—i.e. a ratio of 42.4%.

2.2 U.S. and Canadian Banking Systems

Contrary to the U.S. banking system, which until recently was a unit-branch system, the Canadian banking system is a multi-branch system, a tradition borrowed from the Scottish financial system. Also contrary to its U.S. counterpart, the Canadian banking system is very concentrated, the eight domestic banks controlling more than 90% of banks' total assets. The Canadian banking system was compartmentalized into four pillars until 1987: commercial banks, insurance companies, investment banking (brokers) and trusts. However, the 1987 Amendment to the Bank Act allows banks to get involved in investment banking. The following amendments—especially the 1992 one—grant insurance and fiduciary powers to banks.

Looking at the raw data, note that the loan to asset ratio, a measure of traditional banking, is much higher for Canadian banks than for the 10 largest U.S. banks at the end of the 1980s. However, the ratio declines sharply thereafter (Figure 1). The Canadian ratio eventually becomes similar to the U.S. one, and both are on a downward trend over the sample period (Boyd and Gertler, 1994; Calmès, 2004). Interestingly, the composition of Canadian bank loans changes sharply over the sample period (Figure 2). The proportion of commercial loans drops, with a corresponding increase in mortgage loans, and to a less extent in personal loans. Corporate loans are replaced by corporate securities in bank balance sheet. This increase in the relative share of corporate securities may be explained by the downward trend in interest rates over the sample period. It is also related to the fact that business loans are penalized by the Basel I and Basel II risk-weighted ratios used to compute regulatory capital. This eventually leads to a banking strategy aiming at transferring bank risk off-balance-sheet to decrease credit risk (Brunnermeier, 2009). The rapid development of financial markets since the 1980s—especially the junk bonds and commercial paper markets—also contributes to slow the growth of commercial loans (Berger *et al.*, 1995).

In the U.S, the banking system is traditionally considered as a unit-branch system, the McFadden Act of 1927 prohibiting interstate branch banking. However, in 1994, the Riegle-Neal Interstate Banking and Branching Efficiency Act repeals the McFadden Act. In parallel to this regulatory change there is a trend toward a much greater concentration of bank assets since the early 1990s (Figure 3). Indeed, the 10 largest U.S. banks control less than 25% of total assets in 1990, but this proportion jumps to 53% in 2009. Similar to the Canadian regulation, the Graham-Leach-Bliley Financial Services Modernization Act grants broad investment banking and insurance powers to U.S. banks in 1999. It repeals the 1933 Glass-Steagall Act that prohibits such activities. Importantly, note that the investment restrictions included in the Glass-Steagall Act were already more flexible before 1999. Consequently, as in Canada, the U.S. loan to asset ratio is on a downward trend for the big banks since 1990, and for the medium banks since 2000 (Figure 1).

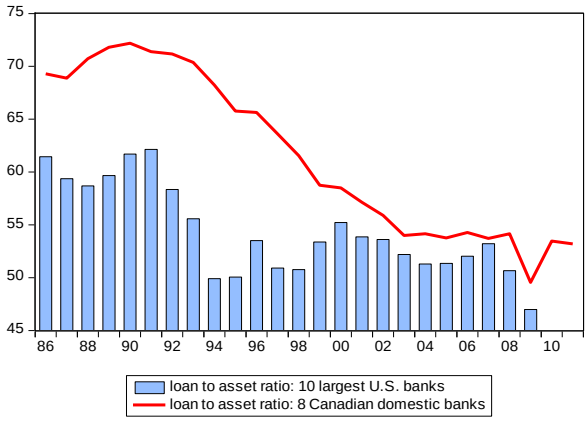


Figure 1. Loan to asset ratio: Canadian banks and U.S. big banks
Sources: Statistics Canada (CANSIM); Federal Reserve Bulletin

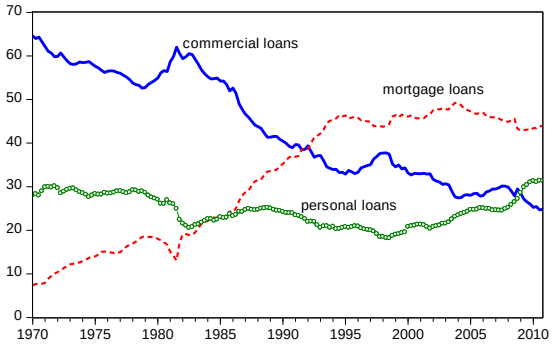


Figure 2. Relative shares of bank loan categories, Canadian banks
Source: Statistics Canada (CANSIM)

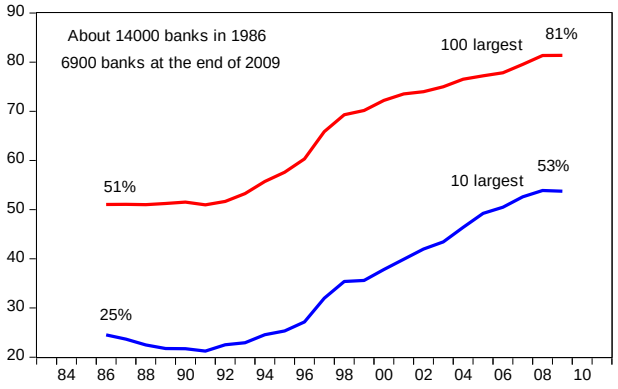


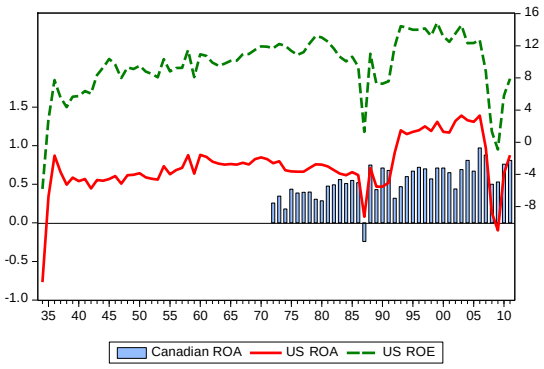
Figure 3. Share of the 10 and 100 largest banks in U.S. banks' total assets (**Source:** FDIC)

3. The Evolution of the Canadian and U.S. Banking Systems[3]

3.1 Trends in U.S. Banking

Based on an extended sample running from 1935 to 2011, a structural break can be identified in the U.S. accounting return data in the early 1990s (Figure 4). There is a clear surge in banks' return on assets (*ROA*), and to a less extent in return on equity (*ROE*). The mean of *ROA* is equal to 0.63% from 1934 to 1991, but rises to 1.23% from 1992 to 2006. A Markov switching regime (MSR) procedure confirms the structural break in *ROA*, with a probability of 0.8 (Figure 5). The likelihood function estimated with the MSR procedure indicates that *ROA* increases from 0.54% to 0.83% from the low to the high volatility regimes, with a corresponding increase in volatility from 0.05 to 0.12. Importantly, note that the *ROA* mean computed over the *low* regime corresponds to the Canadian banks' *average ROA* before the 1987 Amendment to the Bank Act.

[3] Data used in this section are drawn from the Federal Deposit Insurance Corporation (FDIC) historical database with a sample comprising the whole U.S. banks' universe.



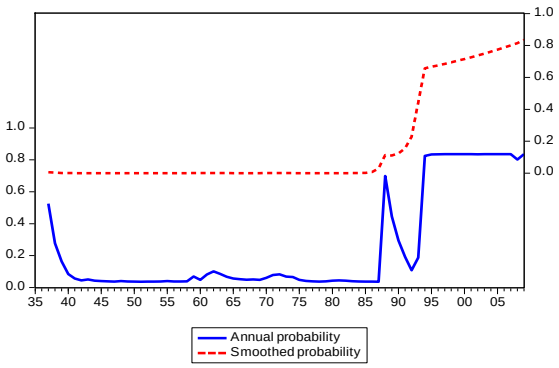


Figure 4. Canadian and U.S. banks' accounting returns **Figure 5.** Markov switching regime applied to U.S. banks' *ROA*

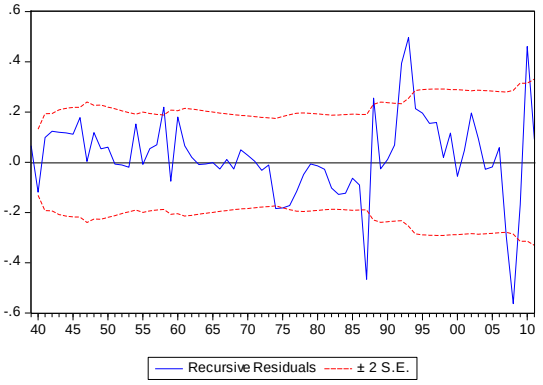
Sources: Statistics Canada (CANSIM); Bank of Canada; Canadian Bankers Association; FDIC.

Note: Figure 5 is built using a Markov switching regime algorithm.

The analysis of the residuals of the recursive regression run on *ROA* confirms this trend. Consider our benchmark model:

$$ROA_t = \alpha + \beta_1 snonin_t + \beta_2 llp_t + \varepsilon_t \qquad (1)$$

where *snonin* is the share of non-interest income in banks' net operating income; *llp* is the ratio of loan loss provisions to assets; and ε is the innovation. The confidence interval of the recursive residuals is clearly wider after 1990, which corroborates the presence of a structural break (Figure 6). An MSR procedure applied to *ROE* also tends to display a similar break (Figure 7).



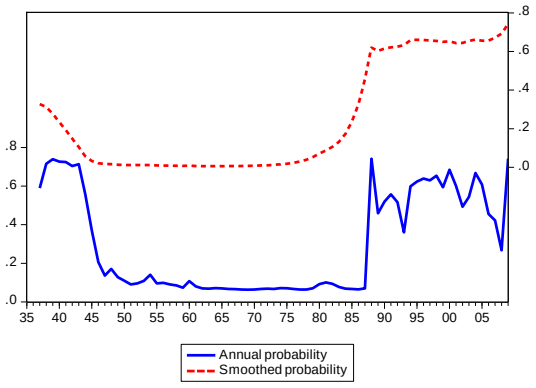


Figure 6. Recursive residuals from the U.S. banks' *ROA* model

Figure 7 Markov switching regime applied to U.S. banks' *ROE*

Note: Figure 7 is built using a Markov switching regime algorithm

Since the most important change in banking over the last decades is its transition from traditional to market-based banking, it is interesting to examine how this transition relates to the structural break observed in banks' performance. To monitor the evolution of the banking system, we rely on the Herfindahl index, computed with *snonin*:

$$H = 1 - \left[snonin^2 + \left(1 - snonin\right)^2 \right] \qquad (2)$$

The *H* index is defined over the interval [0, 0.5]. Complete diversification is associated with the supremum of this interval. The plot of the *H* index shows that U.S. banks are quite diversified before the enforcement of the Glass-Steagall Act, the index being around 0.48 (Figure 8). Then the Act constrains them to abandon investment banking and to only focus on more traditional banking

activities. This leads to a marked increase in the loan to asset ratio and a corresponding decrease in the *H* index until the middle of the 1950s. However, the index resumes its upward trend in the 1980s with the development of securitization.

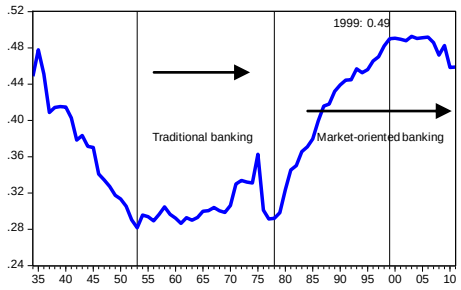


Figure 8. U.S. banks' Herfindahl index
Source: FDIC

The structural rise of *ROA* concomitantly relates to its growing sensitivity to the ratio of non-interest income to assets. Figure 9 plots the conditional covariances[4] between *ROA* and three of its key determinants: net interest margin (*ni*), the ratio of non-interest income to assets[5] (*nii*), and the ratio of loan loss provisions to assets (*llp*). Not surprisingly, the covariance between *ROA* and *nii* features a structural break similar to the *ROA* profile: the covariance takes off in the early 1990s and moves on a steady upward trend until the middle of the 2000s. In parallel, the covariance between *ROA* and *ni* moves downward over the same period. This set of results is a *prima facie* evidence of a change in U.S. banks' performance starting in the early 1990s, which coincides with the greater banks' involvement in non-traditional business lines.

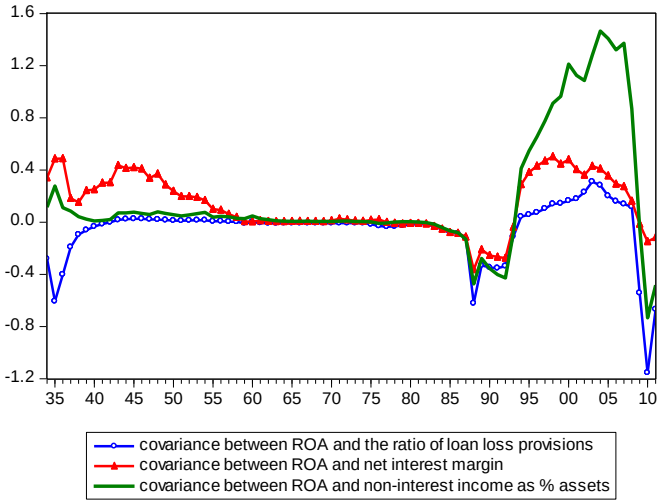


Figure 9. Conditional covariance between U.S. banks' *ROA* and some key components
Note: The conditional covariances are computed using a multivariate GARCH procedure based on a BEKK process.

To further investigate the relative contribution of non-interest income to *ROA*, we run a simple regression *à la* Stiroh (2006) over the period 1935-2011. We first decompose *ROA* in its two main components, *ni* and *nii*: $ROA = w_{ni}ni + w_{nii}nii$, the weights being the relative shares of net interest and non-interest income in banks' net operating income[6]. We then estimate the following regression: $ROA_t = \theta_0 + \theta_1 w_{nit} + \theta_2 w_{niit} + \xi_t$. Since the weights add to one, we just retain w_{niit} in the regression, such that: $ROA_t = \gamma_0 + \gamma_1 w_{niit} + \xi_t$. Hence, the estimated coefficient γ_1 provides the relative contribution of non-interest income to *ROA*. The estimated *ROA* equation then reads as follows: $ROA_t = 0.67 + 0.42 w_{niit} + \xi_t$—i.e., non-interest income may have added up to 42 basis points to *ROA*.

To complete the analysis of the contribution of non-interest income to banks' performance we regress directly *ROA* on *ni*, *nii* and *llp*. Given the obvious endogeneity issue stemming from the

[4] The conditional covariances are computed with a multivariate GARCH process using a BEKK procedure (Bollerslev *et al.*, 1988; Engle and Kroner, 1995)

[5] *nii* must not be confused with *snonin*, which is the share of non-interest income in net operating income.

[6] Note that we implicitly remove non-interest expenses from *ni* and *nii*.

interaction between the equation variables, we rely on the Generalized Method of Moments (GMM) procedure to run the regression. The estimated *ROA* equation obtains:

$$ROA_t = 0.22 + 0.14ni + 0.35nii - 0.79llp + 0.03ROA_{t-1} \qquad (3)$$

All estimated coefficients are significant at the 1% level and the results confirm that *nii* might contribute significantly more than *ni* to bank performance.

Finally, estimating our benchmark *ROA* model (equation (1)) provides additional support to these findings. We rely on Almon lags to estimate the structure of the lagged coefficients for *snonin* and *llp*. For all U.S. banks the sum of the lags of the *snonin* coefficients is equal to 0.96, significant at the 5% level (Table 1). However, this result should be adjusted for risk. Indeed, banks' non-traditional activities tend to be more volatile than traditional business lines (Stiroh and Rumble, 2006; Calmès and Liu, 2009; Calmès and Théoret, 2010). Furthermore, the conditional variance[7] of U.S. banks' ratio of non-interest income to assets (*nii*) is increasing since the end of the 1980s, and this increase corresponds to a structural rise in the *ROA* conditional variance (while the conditional variance of the net interest margin moves downward, Figure 10).

Table 1. Estimation of the *ROA* model on all U.S. banks, 1934-2011

	ROA	***RA_ROA***
c	0.64 (*3.88*)	2.26 (*2.35*)
$snonin_t$	1.49 (*7.87*)	3.67 (*0.63*)
$snonin_{t-1}$	-0.51 (*-2.93*)	3.25 (*3.00*)
$snonin_{t-2}$	-0.01 (*-0.06*)	1.40 (*0.51*)
$snonin_{t-3}$	- (-)	-1.87 (*-0.81*)
Sum of lags	0.96 (*2.19*)	6.46 (*2.04*)
llp_t	-0.22 (*-3.84*)	-1.21 (*-6.40*)
llp_{t-1}	-0.15 (*-3.84*)	-0.90 (*-6.40*)
llp_{t-2}	-0.07 (*-3.84*)	-0.60 (*-6.40*)
llp_{t-3}	- (-)	-0.30 (*-6.40*)
Sum of lags	-0.44 (*-3.84*)	-3.03 (*-6.40*)
y_{t-1}	0.94 (*26.49*)	0.75 (*15.74*)
R^2	0.70	0.47
D.W.	2.16	1.72

Notes: Risk-adjusted *ROA* (*RA_ROA*) is a five-year moving average of *ROA* scaled up by a rolling *ROA* standard deviation of five years. The explanatory variables are: *snonin*, share of non-interest income in net operating income; *llp*, ratio of loan loss provisions over total assets, and y_{t-1}, the dependent variable lagged one period. The *t* statistics are reported in italics in parentheses. The coefficients of *snonin* and *llp* are estimated using an Almon polynomial.

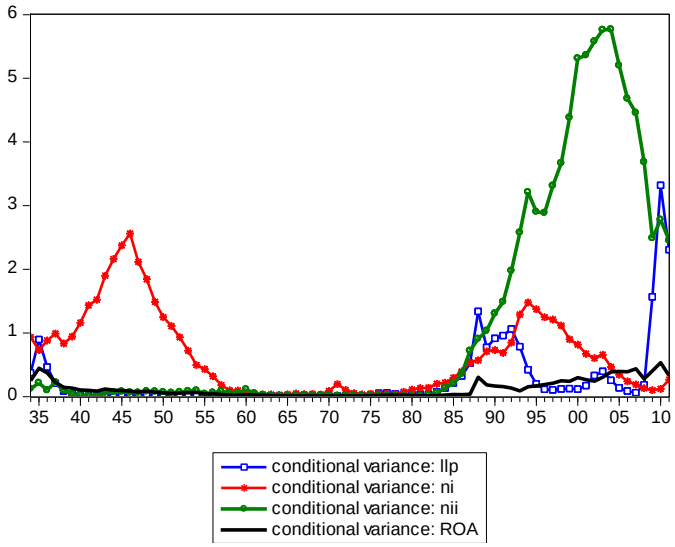


Figure 10 Conditional variances of U.S. banks' *ROA* and some of key components

Notes: The conditional variances are computed using a multivariate GARCH procedure based on a BEKK process. The reported variables are:
llp: loan loss provisions as % of assets;
ni: net interest margin as % of assets;
nii: non-interest income as % of assets.

[7] The conditional variances are estimated using a multivariate GARCH process (Bollerslev *et al.*, 1988; Engle and Kroner, 1995).

Given the greater risk embodied in non-traditional activities, it is important to estimate our equation (1) model on a risk-adjusted basis to rigorously assess the impact of the change towards market-based banking (Stiroh and Rumble, 2006; LePetit *et al.*, 2008; Calmès and Théoret, 2010). We thus define risk-adjusted *ROA* as:

$$RA\_ROA = \frac{R\bar{O}A}{sd\left(ROA\right)} \qquad (4)$$

where $R\bar{O}A$ is the five-year moving average on *ROA*, and $sd\left(ROA\right)$ is the standard deviation of *ROA* computed over five years. Using this risk-adjusted performance measure we find that the sum of the Almon lags for the coefficients of *snonin* is equal to 6.46, significant at the 5% level (Table 1). To summarize, our results seem to suggest that the U.S. banks' risk-return trade-off might have improved *pari passu* with the rise of market-based banking.

3.2 The Structural Break in Canadian Banking Financial Results

As in the U.S., a structural break can be pinned down in Canadian banks' returns (Calmès and Théoret, 2010). This change comes later, in 1997, but is also characterized by a jump in *ROA*, albeit not as impressive (Figure 4 and Table 2). The average *ROA* of Canadian banks is equal to 0.60% compared to 0.74% for the U.S. big banks, and 1% for the U.S. medium ones. Importantly, this discrepancy is also higher during the 2000-2006 period. Note that, *ceteris paribus*, this result already suggests that U.S. banks might actually perform better than Canadian banks. The next section aims at studying this question more comprehensively.

Table 2. *ROA* of Canadian and U.S. banks

		1986-1992	1993-1996	1997-2006	1993-2006	2000-2006	2007-2009	1986-2009
CAN		0.45	0.61	0.69	0.67	0.70	0.64	0.60
US	**big**	0.26	0.91	1.08	1.05	1.14	0.45	0.74
US	**medium**	0.48	1.28	1.50	1.44	1.51	0.18	1.00
US	**small**	0.77	1.20	1.18	1.19	1.16	0.44	0.97
US	**all**	0.54	1.19	1.28	1.22	1.30	0.35	0.93

Notes: Canadian banks comprise the eight domestic commercial banks. U.S. big banks are the top ten banks. Medium banks are the 11 to 100 largest banks. Small banks are the banks not ranked among the 1000 largest by assets.

Sources: Canadian Bankers Association; Bank of Canada; FDIC; Federal Reserve Bulletin.

4. The Relative Performance of U.S. and Canadian Banking Systems

Turning to the evolution of the risk-return trade-off during the transition period, we restrict our analysis to the 1986-2009 period, a period for which Canadian data are available. The statistics we use to make this comparison divide the sample period into four important subperiods: the 1986-1992 subperiod, which includes the sovereign debt turmoil, the real estate collapse episodes and the 1990 recession; the 1997-2006 subperiod, which includes the structural break in the Canadian banks' financial data; the 1993-2006 subperiod, which includes the structural break in the U.S. banks' financial data; and finally the subprime crisis (2007-2009).

4.1 The Relative Levels of Average Performance

As expected, using a risk-adjusted *ROA* based on a moving average of the unconditional volatility, Canadian banks seem to outperform their U.S. peers over the whole sample period (Table 3). However, we argue that this result is only driven by the periods of financial crisis and economic slowdowns, Canadian banks displaying a better resiliency than the U.S. big banks in times of crises (1986-1992)—especially the subprime crisis (2007-2009). Indeed, in the other periods, both the 1993-2006 and 1997-2006 subperiods, Canadian banks actually *underperform* their U.S. peers in terms of risk-adjusted *ROA*.

Table 3. Risk-adjusted *ROA* of Canadian and U.S. banks

		1986-1992	1993-1996	1997-2006	1993-2006	2000-2006	2007-2009	1986-2009
CAN		1.32	5.54	4.93	5.15	4.38	2.37	2.61
US	**big**	0.43	8.27	7.20	7.00	10.36	1.29	1.48
US	**medium**	1.37	25.60	13.64	10.29	12.58	0.24	1.61
US	**small**	4.05	30.00	19.67	19.83	29.00	0.85	2.94
US	**all**	2.08	59.50	16.00	15.25	14.44	0.66	2.11

Notes: Canadian banks comprise the eight domestic commercial banks. U.S. big banks are the top ten banks. Medium banks are the 11 to 100 largest banks. Small banks are the banks not ranked among the 1000 largest by assets. *ROA* is adjusted for risk with unconditional volatility. Risk-adjusted *ROA* (*RA_ROA*) is a five-year moving average of *ROA* scaled up by a rolling *ROA* standard deviation of five years.
Sources: Canadian Bankers Association; Bank of Canada; FDIC; Federal Reserve Bulletin.

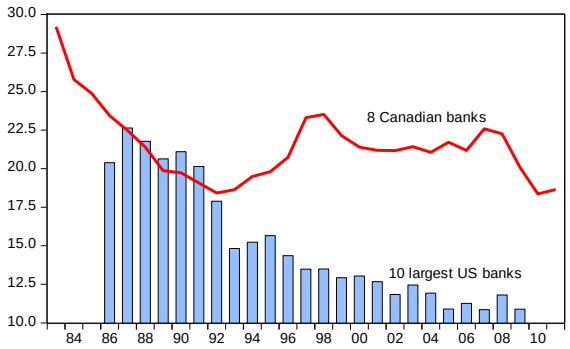
Using *ROE* (*ROA* scaled up by financial leverage, i.e., the assets to equity ratio) Canadian banks still seem to perform better than U.S. banks—especially the ten largest U.S. banks. Over the whole sample period, *ROE* is equal to 12.70% for Canadian banks and 10.07% for the 10 largest U.S. ones (Table 4). However, this result hides a crucial caveat, namely the fact that the Canadian *ROE* is in fact magnified by leverage. For example, over the whole sample period, Canadian banks' leverage is equal to 21.17 compared to only 13.61 for the top ten U.S. banks. Furthermore, U.S. banks' leverage decreases substantially over the 1986-2009 period, whereas Canadian banks' leverage remains near 21 (Figure 11).

Table 4. *ROE* of Canadian and U.S. banks

		1986-1992	1993-1996	1997-2006	1993-2006	2000-2006	2007-2009	1986-2009
CAN		9.16	12.16	15.07	14.23	15.03	13.82	12.70
US	**big**	5.16	14.40	13.31	13.62	13.68	4.97	10.07
US	**medium**	8.01	16.69	16.20	16.34	15.54	1.65	12.07
US	**small**	8.98	12.26	11.40	11.65	11.17	4.00	9.92
US	**all**	8.25	14.79	14.20	14.38	13.98	3.47	11.23

Notes:. Canadian banks comprise the eight domestic commercial banks. U.S. big banks are the top ten banks. Medium banks are the 11 to 100 largest banks. Small banks are the banks not ranked among the 1000 largest by assets.
Sources: Canadian Bankers Association; Bank of Canada; FDIC; Federal Reserve Bulletin.

Not surprisingly, if we scale up *ROE* for risk with an unconditional volatility moving average, the return differential narrows substantially, and Canadian banks do no longer outperform U.S. banks by much over the whole sample period. More importantly, this result is again driven by the crisis episodes. Indeed, both in the 1993-2006 and 1997-2006 sub-periods, the risk-adjusted *ROE* is



systematically lower for Canadian banks. For instance, during the 1997-2006 sub-period, risk-adjusted *ROE* is equal to 5.25 for Canadian banks versus 9.57 for the big U.S. ones.

Figure 11. Canadian and top ten U.S. banks' leverage (*A/E*)
Source: Canadian Bankers Association; Bank of Canada; Federal Reserve Bulletin.

4.2 ROA and Conditional Volatility

Since the unconditional return volatility is not model-based, it tends to be a rough measure of bank risk. Besides, this indicator is generally unstable as it is computed on a rolling window. By contrast, the conditional volatility computed with a GARCH procedure better captures the non-linearities embedded in returns, like the asymmetries and fat tails typical of return distributions. The conditional volatility is also smoother as it is based on an autoregressive process, which translates into a smoother time series for the risk-adjusted measure of bank return.

Scaling *ROA* with the conditional volatility strengthens the results previously obtained with the unconditional volatility moving average (Figure 12). When the conditional volatility[8] of *ROA* is low—i.e., in times of economic expansion—*ROA* tends to be relatively higher (left panel), which then boosts the risk-adjusted *ROA* measure (right panel). And vice-versa in times of slowdowns or financial crises. These comovements tend to amplify the cycles of the risk-adjusted *ROA* measure. More importantly, they have important implications in the comparative study of the two banking systems. Indeed, the results show that the U.S. conditional volatility tends to be relatively higher in downturns, whereas the Canadian conditional volatility seems to remain higher in normal times. This explains why Canadian banks appear to be outperforming. In fact, our results suggest that this tendency is mainly driven by the higher conditional volatility of U.S. banks' returns during financial crises.

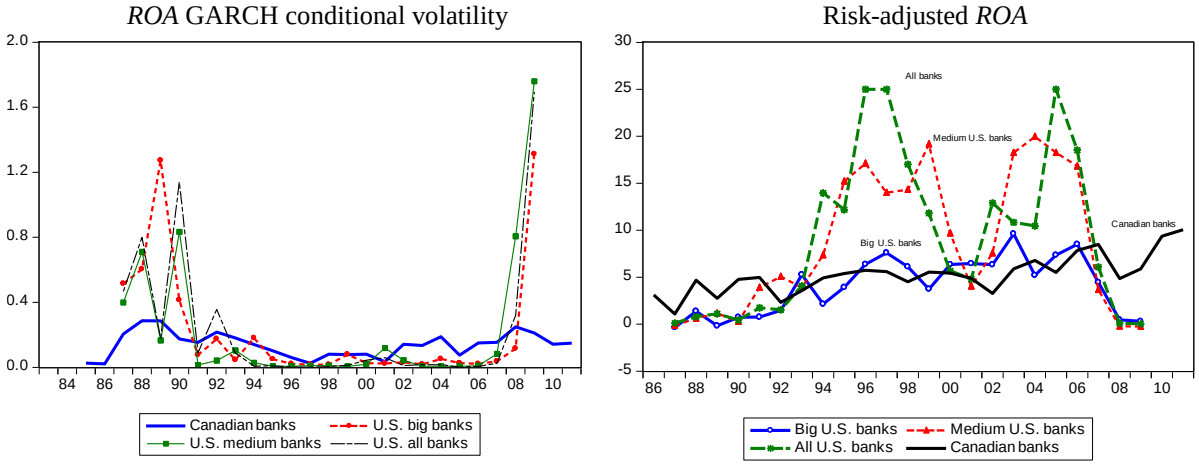


Figure 12. *ROA* GARCH conditional volatility(Left panel) and risk-adjusted *ROA* (Right panel)
Notes: Risk-adjusted *ROA* is the ratio of *ROA* to its conditional volatility computed with a standard GARCH process.

[8] Note that this pattern holds also for the unconditional volatility and it is even more pronounced.

This alternative risk-adjustment method thus confirms that Canadian banks essentially perform better than U.S. banks in periods of turmoil—i.e., the subperiods 1986-1992 and 2007-2009. The conditional volatility of Canadian banks' *ROA* is rather low during these crises periods, while the U.S. banks' volatility jumps for all size categories (due mainly to the increase in loan loss provisions). Furthermore, Figure 12 also reveals that the cycles of risk-adjusted *ROA* display a greater amplitude in the U.S. than in Canada, risk-adjusted *ROA* increasing more in the U.S. than in Canada in expansion, but decreasing more in contraction.

Not surprisingly, since the risk-adjustment method based on conditional volatility explicitly accounts for banks' returns non-linearities, the performance of Canadian banks appears more similar to U.S. big banks' pattern over the whole sample period. In other words, this estimation method suggests that the performance of Canadian banks might be less impressive than previously thought (right panel of Figure 12). This observation relates to the fact that bank risk, as captured by the conditional volatility of *ROA*, is actually *higher* in Canada than in the U.S. during the expansion periods (left panel of Figure 12).

4.3 ROA Estimation Results

An estimation of our *ROA* model (equation (1)) based on absolute and risk-adjusted measures sheds additional light on the relative merits of the Canadian and U.S. banking systems. Table 5 provides the estimation of our benchmark *ROA* model (equation (1)) for Canadian banks and U.S. banks classified by size. This estimation is performed using a GARCH (1,1) process in order to tackle the conditional heteroskedasticity embedded in the equation innovation (Bollerslev, 1986).

Table 5. Estimation of the *ROA* model

	Canadian Banks		**U.S. Banks**							
			Big		**Medium**		**Small**		**All U.S. banks**	
	1986-2009	**1997-2009**	**1986-2009**	**1997-2009**	**1986-2009**	**1997-2009**	**1986-2009**	**1997-2009**	**1986-2009**	**1997-2009**
c	0.73	-0.11	-0.05	-0.38	-0.41	-1.40	1.13	1.17	0.12	-0.66
	10.93	*-0.67*	*-0.27*	*-1.65*	*-2.24*	*-1.61*	*10.48*	*5.14*	*1.23*	*-2.72*
snonin	**0.23**	**1.93**	**2.80**	**3.55**	**5.33**	**6.74**	**1.57**	**1.28**	**3.41**	**5.22**
	4.17	***6.10***	***6.43***	***8.03***	***13.67***	***4.00***	***4.00***	***1.55***	***13.63***	***9.52***
llp	-0.44	-0.63	-0.59	-0.44	-0.94	-0.57	-1.30	-1.24	-0.74	-0.68
	-6.14	*-7.89*	*-27.23*	*-37.30*	*-19.73*	*-5.35*	*-14.54*	*-5.93*	*-23.43*	*-122.16*
ROA_{t-1}	-0.06	0.22	0.55	0.45	0.06	0.41	0.15	0.46	0.31	0.36
	-0.96	*2.09*	*13.01*	*11.12*	*0.37*	*3.18*	*1.33*	*3.45*	*4.41*	*3.81*
Adj. R^2	0.48	0.61	0.77	0.83	0.90	0.88	0.85	0.81	0.94	0.94
D.W.	2.10	2.10	2.25	1.55	1.61	1.55	1.70	2.00	1.50	1.64

Notes: The explanatory variables are: *snonin*, share of non-interest income in net operating income; *llp*, ratio of loan loss provisions over total assets, and ROA_{t-1}, the dependent variable lagged one period. The *t* statistics are reported in italics.

Table 6 concerns the corresponding estimation of the risk-adjusted *ROA* model based on the *conditional* volatility defined as: $\text{Risk-adjusted } ROA_t = \dfrac{ROA_t}{\text{conditional volatility}_t}$. To compute the conditional volatility we also rely on a GARCH(1,1,) process. We estimate these models over the whole sample period (1986 to 2009), but also over the 1997-2009 subperiod since a structural break is identified around 1997 in the Canadian database.

Table 6. Risk-adjusted *ROA* estimated with conditional volatility, 1986-2009

	Canadian Banks		U.S. Banks							
			Big		Medium		Small		All U.S. banks	
	1986-2009	1997-2009	1986-2009	1997-2009	1986-2009	1997-2009	1986-2009	1997-2009	1986-2009	1997-2009
c	5.57	-0.31	-2.92	-12.42	-20.59	9.45	-6.50	-21.14	-7.12	-8.95
	2.39	*-0.10*	*-3.30*	*-2.47*	*-1.42*	*0.29*	*-0.77*	*-1.08*	*-1.73*	*-0.75*
snonin	**2.47**	**17.00**	**15.20**	**33.97**	**77.73**	**15.28**	**62.83**	**101.11**	**64.39**	**52.73**
	0.51	***2.94***	***8.29***	***3.19***	***2.18***	***0.22***	***1.82***	***1.21***	***6.00***	***1.83***
llp	-4.63	-5.96	-1.56	0.50	-4.03	-6.36	-5.28	0.76	-12.90	-6.76
	-5.90	*-3.05*	*-10.94*	*0.87*	*-1.50*	*-1.75*	*-1.25*	*0.23*	*-1.98*	*-3.59*
RA_ROA$_{t-1}$	0.53	0.82	0.59	-0.01	0.53	0.35	0.81	0.90	0.14	0.24
	2.07	*3.84*	*9.97*	*-0.03*	*2.45*	*1.15*	*5.47*	*5.19*	*0.69*	*1.12*
Adj. R^2	0.52	0.49	0.56	0.55	0.56	0.41	0.73	0.69	0.45	0.65
D.W.	1.86	1.50	1.50	1.72	1.50	1.60	0.93	0.79	1.50	2.20

Notes: The explanatory variables are: *snonin*, share of non-interest income in net operating income; *llp*, ratio of loan loss provisions over total assets, and RA_*ROA*$_{t-1}$, the dependent variable lagged one period. The *t* statistics are reported in italics. Risk-adjusted *ROA* is the ratio of *ROA* to its conditional volatility, where conditional volatility is estimated using a standard GARCH process.

The Canadian *ROA* sensitivity to *snonin* substantially improves after the 1997 structural break. More precisely, the sensitivity of Canadian banks' *ROA* to *snonin* is higher over the 1997-2009 period than before, the *snonin* coefficient being estimated at 1.93, significant at the 1% level (Table 5). However, the sensitivity of U.S. banks' *ROA* to *snonin* increases even more after 1997. Over the whole sample period (1986-2009), the sensitivity of big banks' *ROA* to *snonin* is equal to 2.80, but to 3.55 for the period 1997-2009. The corresponding figures for medium banks are even higher, 5.33 and 6.74 respectively. Hence, even if their performance in non-traditional activities improves, Canadian banks do not catch up in relative terms. Indeed, these results reveal that U.S. banks clearly get better gains from market-based banking.

Since the 1997-2009 period is characterized by a new volatility regime, adjusting for risk with the conditional volatility better reflects the change in the banking return patterns. However, the estimations only come to reinforce our previous findings. Indeed, although the fit of the model tends to deteriorate in the second subperiod, the results are broadly consistent with those obtained with the *ROA* benchmark model (Table 6). While the sensitivity of Canadian banks' *ROA* to *snonin*, albeit low, is significant from 1986 to 2009, this is not the case for risk-adjusted *ROA*. Furthermore, although the coefficient of *snonin* become significant and jumps to 17.00 after the structural break, the corresponding change in the U.S. is obviously more pronounced, the respective coefficients being equal to 15.20 and 33.97— both significant at the 1% level.

4.4 What Difference the Product-mix Can Make?

To understand why U.S. banks seem to benefit more from market-based banking, it is necessary to examine the sources of bank income. The average *snonin* is equal to 41.6% for Canadian banks and to 44.8% for the ten largest U.S. banks over the whole sample period (Table 7). Since the beginning of the transition towards market-based banking, *snonin* is greater for Canadian banks than for the top 10 U.S. banks, and the *snonin* of the two groups are quite close since the subprime crisis (Figure 13). Despite their apparently greater involvement in non-traditional activities, Canadian banks actually display a lower ratio of non-interest income to assets (*nii*) than U.S. banks. For example, over the whole sample period, the *nii* of Canadian banks and the ten largest U.S. banks are respectively equal to 1.54% and 2.24% (Table 8).

Table 7. *snonin* of Canadian and U.S. banks

		1986-1992	1993-1996	1997-2006	1993-2006	2000-2006	2007-2009	1986-2009
CAN		29.03	34.81	51.27	46.57	52.51	47.59	41.58
US	**big**	43.41	46.58	46.02	46.18	45.61	41.97	44.30
US	**medium**	36.68	38.72	46.98	44.62	47.66	43.80	41.51
US	**small**	20.08	23.60	25.57	25.00	25.35	24.54	23.16
US	**all**	31.92	35.82	42.67	40.71	43.16	40.14	37.64

Table 8. Non-interest income as percentage of assets

		1986-1992	1993-1996	1997-2006	1993-2006	2000-2006	2007-2009	1986-2009
CAN		1.16	1.37	1.91	1.75	1.97	1.42	1.54
US	**big**	2.21	2.51	2.37	2.41	2.33	1.92	2.24
US	**medium**	1.88	2.41	3.13	2.92	3.13	2.48	2.52
US	**small**	1.03	1.35	1.40	1.39	1.35	1.17	1.23
US	**all**	1.67	2.11	2.49	2.47	2.47	1.99	2.09

Notes to Tables 7 & 8: Canadian banks comprise the eight domestic commercial banks. U.S. big banks are the top ten banks. Medium banks are the 11 to 100 largest banks. Small banks are the banks not ranked among the 1000 largest by assets.
Sources: Canadian Bankers Association; Bank of Canada; FDIC; Federal Reserve Bulletin.

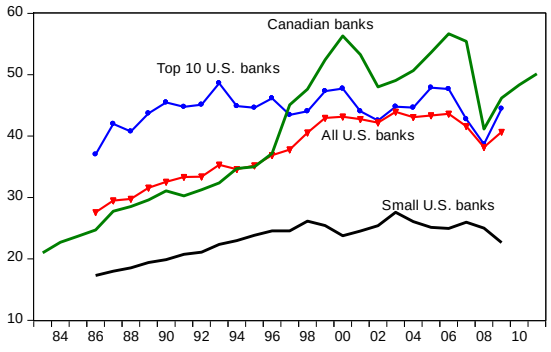


Figure 13. *snonin* of Canadian and U.S. banks
Source: Canadian Bankers Association; Bank of Canada; Federal Reserve Bulletin.

Beyond size effects, we can safely assume that U.S. banks get a greater return from their market-based banking because of their particular product-mix. For example, U.S. banks are obviously more involved in securitization than Canadian banks. Ginnie Mae engineers the first mortgage-backed security in 1970, while a similar program is launched only in 1987 by the Canadian Mortgage and Housing Corporation (CMHC). In 1999, the share of securitization in Canadian bank funding is close to 0% and rises to only 14% at the end of 2009. At the end of 2007 still, only 22% of the outstanding home mortgages are securitized in Canada, versus almost 60% in the U.S (Figure 14).

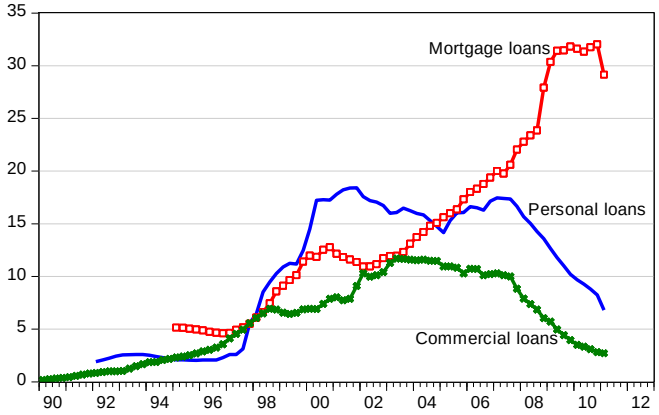


Figure 14. Shares of Canadian securitized loans
Source: Statistics Canada (CANSIM)

Canadian banks rely on securitization mainly to overcome the decline of the share of personal deposits in their sources of funds (Martin-Olivier and Saurina, 2007; Agostino and Maccuza, 2008)[9]. Yet, if Canadian banks rely less on securitization to fund their operations, *ceteris paribus* they must resort to more debt, which contributes to increase their on-balance-sheet leverage (Pennacchi, 1988; Calomiris and Mason, 2004; Ambrose *et al.*, 2005; Uzun and Web, 2007). Reciprocally, leverage and the share of securitization in banks' net operating income are negatively correlated (Gorton and Metrick, 2012). In other words, the fact that Canadian banks rely less on securitization might be due to their relatively higher leverage, and this, in turn could help explain why U.S. banks can benefit more from market-based banking in most periods (Bannier and Hansel, 2008; Cardone-Riportella *et al*, 2010).

As a matter of fact, the fees generated by securitization seem to have a major positive impact on banks' risk-return trade-off (Calmès and Théoret, 2013). First, in normal times, securitization is a quite stable source of income since the risk of default on the SIV's portfolios is low and a great proportion of the securities included in these portfolios is guaranteed by government agencies. Second, the correlation between securitization fees and the other kinds of bank income streams is rather low, suggesting that securitization provides significant diversification benefits (Calmès and Théoret 2013). Third, securitization tends to be a less expensive source of funds compared to borrowed funds. Finally, although this fact is not documented in the literature, some experiments we make suggest that the ratio of expenses related to securitization could be relatively low in terms of assets. In conclusion, the relative performance of the two banking systems could well be related to product-mix differences. We investigate this question in more detail in the next section.

Financial results are therefore more volatile for Canadian banks than for the top 10 U.S. banks, an important fact largely overlooked in the literature. We assume that this result might relate to a Canadian product mix weighting more volatile activities, i.e., market-oriented sources of income such as trading income and fees stemming from capital markets (underwriting fees, etc.). Indeed, Table 9 shows that the components most related to market-based banking—trading income, investment banking fees and mutual fund fees—weight heavily in the Canadian banks' financial income statements. For instance, at the end of 2006, the share of trading income in non-interest income is equal to 18% for the Canadian banks versus 8% in the U.S., trading income being the major source of the non-interest income growth conditional volatility (Stiroh and Rumble, 2006; Calmès and Liu, 2009; Calmès and Théoret, 2013).

The contrast between the product-mix of the two banking systems is even more striking if we look at the share of investment banking fees in non-interest income. At the end of 2006, these shares are respectively 19% for Canadian banks versus only 5% for U.S. banks. In contrast to the U.S. banking system, where commercial banks control only a limited portion of investment banking, Canadian banks own the majority of domestic investment banks since the 1987 Amendment to the Bank Act (Bordo *et al*., 2011). This greater involvement in investment banking partly explains why Canadian banks are actually more exposed to financial market volatility than their U.S. peers. Since deposit fees represent a larger share of banks' non-interest income in the U.S. than in Canada (respectively 15% versus 12% in 2006, Table 9), and given that these fees are a relatively stable source of income (Calmès and Théoret, 2012), they certainly contribute to explain the relative stability of U.S. banks' non-interest income.

[9] In contrast, securitization in the U.S. relates to risk shifting, the search for performance and capital arbitrage (Cardone-Riportella, *et al.*, 2010).

Table 9. Canadian and U.S. banks' product-mix

Components of non-interest income (U.S.$ millions)						
	Canadian banks			U.S. banks		
	2001	**2006**	**2009**	**2001**	**2006**	**2009**
Assets	1481506	1961024	2705350	7730464	11587972	13279658
net interest income	27596	30012	44090	251132	330124	397677
non-interest income	31383	39147	37847	170574	240444	260502
operating income	58979	69159	81937	421706	570568	658179
share noninterest income	0.53	0.57	0.46	0.40	0.42	0.40

Non-interest income components	Canadian banks			U.S. banks		
	2001	**2006**	**2009**	**2001**	**2006**	**2009**
fiduciary activities	*4010*	*6376*	*6933*	*20829*	*25322*	*24454*
deposit fees	*3900*	*4634*	*5534*	*27208*	*36300*	*41675*
Trading income	*6658*	*7190*	*2961*	*12532*	*19036*	*24926*
Investment banking fees	*10932*	*12751*	*9377*	*9132*	*12001*	*12001*
Net servicing fees	-	-	-	*10593*	*14483*	*29667*
Securitization income	*1325*	*1435*	*3845*	*16246*	*22170*	*4761*
Insurance commissions	*2715*	*5569*	*8574*	*2779*	*4437*	*3882*
Other	*1843*	*1192*	*623*	*71255*	*106695*	*119136*
Shares of non-interest income components in total non-interest income						
	Canadian banks			U.S. banks		
	2001	**2006**	**2009**	**2001**	**2006**	**2009**
fiduciary activities	0.13	0.16	0.18	0.12	0.11	0.09
deposit fees	0.12	0.12	0.15	0.16	0.15	0.16
Trading income	0.21	0.18	0.08	0.07	0.08	0.10
Investment banking fees	0.35	0.33	0.25	0.05	0.05	0.05
Net servicing fees	-	-	-	0.06	0.06	0.11
Securitization income	0.04	0.04	0.10	0.10	0.09	0.02
Insurance commissions	0.09	0.14	0.23	0.02	0.02	0.01
Other	0.06	0.03	0.02	0.42	0.44	0.46
Shares of non-interest income components in total non-interest income (excluding other income)*						
	Canadian banks			U.S. banks		
	2001	**2006**	**2009**	**2001**	**2006**	**2009**
fiduciary activities	0.14	0.17	0.19	0.21	0.19	0.17
deposit fees	0.13	0.12	0.15	0.27	0.27	0.29
Trading income	0.23	0.19	0.08	0.13	0.14	0.18
Investment banking fees	0.37	0.34	0.25	0.09	0.09	0.08
Net servicing fees	-	-	-	0.11	0.11	0.21
Securitization income	0.04	0.04	0.10	0.16	0.17	0.03
Insurance commissions	0.09	0.15	0.23	0.03	0.03	0.03

* We exclude the other non-interest income from the total because the share of other non-interest income in the total is much higher in the U.S. than in Canada.

Non-interest income as percentage of total assets						
	Canadian banks			U.S. banks		
	2001	**2006**	**2009**	**2001**	**2006**	**2009**
net interest income	1.86	1.53	1.63	3.25	2.85	2.99
non-interest income	2.12	2.00	1.40	2.21	2.07	1.96
fiduciary activities	*0.27*	*0.33*	*0.26*	*0.27*	*0.22*	*0.18*
deposit fees	*0.26*	*0.24*	*0.20*	*0.35*	*0.31*	*0.31*
Trading income	*0.45*	*0.37*	*0.11*	*0.16*	*0.16*	*0.19*
Investment banking fees	*0.74*	*0.65*	*0.35*	*0.12*	*0.10*	*0.09*
Net servicing fees	-	-	-	*0.14*	*0.12*	*0.22*
Securitization income	*0.09*	*0.07*	*0.14*	*0.21*	*0.19*	*0.04*
Insurance commissions	*0.18*	*0.28*	*0.32*	*0.04*	*0.04*	*0.03*
Other	*0.12*	*0.06*	*0.02*	*0.92*	*0.92*	*0.90*

Sources: Bank of Canada, OSFI, FDIC (Bank Call Report)

5. Conclusion

The Canadian banking system has the reputation of being one of the best in the world. However, based on the empirical evidence we gather in this study this conjecture seems questionable. Market-based banking is now well entrenched in Canada and the U.S. This new regime is characterized by greater risk but also larger compensating risk premia on banks' business lines. A structural break in banks' accounting returns is indeed observed in Canada, but even more so in the U.S. After the break, we find that U.S. banks often display greater returns than Canadian banks, both on their traditional and non-traditional activities. Importantly, we also find that banks' financial results are more volatile in Canada than in the U.S. Overall, when properly scaling up performance for risk, it is hard to believe that the Canadian banking system is really "stronger"[10].

In this paper we argue that a major difference between the Canadian and U.S. banking models pertains to their relative product-mix. U.S banks rely more on securitization, while Canadian banks generate more income from the activities related to market-oriented banking, like trading income and capital market and mutual fund fees. Securitization should increase banks' on-balance-sheet risk, which could reduce the relative stability of the U.S. banking system. However, market-oriented business lines lead to even more volatility in Canadian banks' financial results, which is compounded by a higher financial leverage. Although it would be difficult to disentangle the risk premia associated with each source of risk, it remains that the Canadian banking system does not seem to take full advantage of the market-sensitive income sources.

Lower loan riskiness, higher regulatory capital ratios, and lower interest margins can certainly yield lower ratios of loan loss provisions, but even this fact appears insufficient to argue that the Canadian banking system is preferable. The subprime crisis was caused by events that were for a great part exogenous to the U.S. banking system. Securitization per se is not to blame—*au contraire*—but rather bad housing policy. If the Canadian banking system had been confronted to a comparable shock, its resiliency would have likely been limited. Indicative of this is the impact the collapse of the asset-backed commercial paper (ABCP) market has had on Canadian banks during the subprime crisis. This would have been much worse had Canadian banks been more exposed to the ABCP market. Fortunately they were not.

[10] This terminology refers to Mike Carney's address at the University of Alberta–Monetary Policy after the Fall, Eric J. Hanson Commemorative Conference– delivered on May 1st 2013.

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