

The Impact of the Subprime Crisis on Canadian Banks' Stock Returns

Jean-Pierre Gueyie*

Abstract

This paper analyses the impact of the United States' (US) subprime crisis on Canadian banks' stock returns, using event study methodology. Our results suggest that despite their holdings of US toxic (subprime) mortgage-backed assets, Canadian banks have been solid in the face of the subprime crisis and the global 2007-2008 financial crisis. In spite of the huge 2007-2008 US financial turmoil, characterized by the failure of many financial institutions, Canadian banks' stock returns were not negatively impacted by subprime events before March 14-16, 2008; more than a year after the beginning of the crisis. The fear of contagion coming from the US has been very limited. As shown by the CIBC case—the most exposed Canadian bank to subprime assets—the situation has been very well managed by banks. Moreover, the Government of Canada Insured Mortgage Purchase Program and Canadian Lenders Assurance Facility had been very helpful, and had positively impacted Canadian banks' stock returns.

Keywords: Canadian chartered banks, subprime crisis, market reaction.

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* Department of finance, School of Management, University of Quebec in Montreal, Montreal, Quebec, Canada H3C 4R2. Email: gueyie.jean-pierre@uqam.ca. Phone: 514. 987-3000. Extension 2358.

1 – Introduction

The subprime crisis that originated in the United States (US) in 2007 is one of the most significant events of the last half-century. Blamed as the precursor of the 2007-2008 world economic crisis, it particularly affected the US banking industry, which has recorded many bank failures or arranged mergers in attempts to avoid failures.

There are some good reasons for assessing the behaviour of Canadian banks' stock returns during the subprime crisis: First, Canada is a neighbour of the US and the two countries are important commercial and economic partners. A difficulty originating in the US can quickly be transmitted to Canada. Moreover, Canadian banks at the time of the crisis held significant amounts of subprime asset-backed securities and were forced to record write-downs. These write-downs, plus bad news about the US and international subprime meltdown, could have had a negative impact on Canadian banks' stock returns. On the other hand, if Canadian banks' investors relied on the legendary solidity of Canadian banks, they could have considered US subprime events to be of little impact, which would have yielded a negligible effect on Canadian banks' stock returns. For instance, on August 2, 2007 Dominion Bond Rating Services (DBRS), a rating agency whose opinions influence investors, claimed that Canadian banks faced limited exposure to the US subprime mortgage market. DBRS expected these banks to make some write-downs, but estimated the magnitude to be manageable relative to their earnings and capital.

Canadian banks' market reaction to subprime events, then, is an empirical issue. It is addressed in this paper, using event study methodology, with Seemingly Unrelated Regressions.

Our results suggest that despite their holdings of US toxic (subprime) mortgage-backed assets, Canadian banks have been very solid in the face of the subprime crisis. In spite of the huge 2007-2008 US financial turmoil, characterized by the failure of many financial institutions, Canadian banks' stock returns were not negatively impacted before March 14-16, 2008; i.e., more than a year after the beginning of the crisis. The fear of contagion coming from the US has been very limited. As shown by the Canadian Imperial Bank of Commerce (CIBC) case—the Canadian bank most exposed to toxic US subprime assets—the situation has been very well managed by banks. Moreover, the Government of Canada Insured Mortgage Purchase Program (IMPP) and Canadian Lenders Assurance Facility (CLAF) had been

very helpful, and had positively impacted Canadian banks' stock returns.¹

The remainder of the paper is organized as follows: Section 2 briefly reviews the literature. Section 3 is devoted to data and methodology. Section 4 presents and discusses the results and Section 5 presents our conclusions.

2 - Brief literature review

With the globalization of world economies, international events (particularly crises events) provide a motivation for researchers to investigate the spill-over of these events into other capital markets, economies or economic sectors. This was also the case for the Asian crisis (Chakrabarti & Roll, 2002); the September 11, 2001 terrorist attack (Charles & Darne, 2006; Nikkinen, Omran, Sahlstrom, & Aijo, 2008); the Mexican Pesos crisis (Mathur, Gleason, Dibooglu, & Singh, 2002); and the US corporate scandals (Ivaschenko, 2004), to name but a few.

The US subprime crisis did not occur in isolation. Several papers have analysed its impact on other financial markets, financial sectors or economies.

Longstaff (2010) uses a Vector Autoregression (VAR) approach to test the extent to which ABX index (the index of asset-backed securities) returns relate to other financial markets, as well as to various measures of market activity, liquidity and funding availability. He finds ABX index returns to have a significant forecasting power for stock returns, treasury yield changes, corporate yield spread changes and changes in the VIX volatility index as far as three weeks ahead. He also finds ABX returns to have significant predictive power for trading activity in financial stocks, trading disruptions in fixed-income markets, and the availability of short-term, asset-backed financing during the crisis. The crisis in US mortgage-backed securities was propagated to other asset classes. But Longstaff finds the predictive power of ABX returns to be of short-, rather than long-term, since the crisis dissipated during the year 2008.

Dooley and Hutchison (2009) analyse the transmission of US subprime crisis news to the debt market (Credit Default Swap –CDS– spreads) in 14 emerging markets. Dividing the crisis period (February 2007 to March 2009) into three phases, they find that in phase 1 (February 2007 to May 19, 2008), the 14 sample countries' debt markets were relatively isolated and decoupled from the developments in the US financial market. However, in phase 2 (May 19, 2008 to the time of Lehman Brothers' failure, i.e., on September 15 2008),

¹ The goal of these programs was to provide liquidity and temporary insurance to Canadian banks during the US mortgage crisis period.

these emerging markets started responding to the deteriorating situation in the US. Responses became very strong in phase 3, i.e., after the failure of Lehman Brothers (September 16, 2008 to March 2009). In other words, these sample emerging markets recoupled with industrialized countries markets after the failure of Lehman Brothers.

Chong (2011) analyses the impact of the subprime crisis on both returns and volatility of the US stock market (the S&P 100 Index). Dividing the crisis period into three sub-periods, he finds no significant change in the mean returns across different sub-periods, but a significant volatility increase during the crisis. However, the impact of subprime shocks on volatility is, according to him, transitory, since it decays in time with a very slow rate. Celikkol, Akkoc, and Akarim (2010) also provide evidence of volatility increase in Turkey's stock market following the bankruptcy of Lehman Brothers.

This paper focuses on returns, and specifically, on the impact of the US subprime crisis on the stock returns of individual Canadian banks.

3 - Data and methodology

3.1 – Data

Daily data are used in this paper. They consist of returns of the big six Canadian chartered banks; the level of the Toronto Stock Exchange (TSX) total index with dividends (market index); the level of the Financial Services total index with dividends; rates on 10-year Government of Canada bonds; rates on treasury bills with one-month maturity; and the Canadian dollar exchange rate relative to the US dollar.² Bank returns data and market index data are retrieved from the Canadian Financial Markets Research Center (CFMRC) database. Data on interest rates and exchange rates are provided by the Bank of Canada. Returns on market and financial services indices are computed using the formula $\ln[(P_t/P_{t-1})]$, where P_t is the level of the total index with dividends at time t . Returns on interest rates are computed using the formula $[(R_t - R_{t-1})/R_{t-1}]$, where R is the interest rate used. Similarly, returns on exchange rates are computed using the formula $(F_t - F_{t-1})/F_{t-1}$, where F_t is the exchange rate expressed in units of Canadian dollar per unit of US dollar.³ All data run from

² The Canadian/USA exchange rate is used as foreign exchange index, because of the proximity and the strength of commercial links between the two countries.

³ Since the subprime crisis originated in the US, we consider the Canada/US exchange rate to

2003-01-02 to 2010-12-31, a period that covers the pre-subprime crisis, the subprime crisis, and the post-subprime crisis.

We consider both US/International events and selected Canadian domestic events. US/International events are adapted from Longstaff (2010). They are reported in Table 1 below:

Table 1: US and international subprime events

Date	Event(s)	Label
Feb 7, 2007	Europe's biggest bank, HSBC Holdings, blames soured US subprime loans for its first-ever profit warning	D01
Apr 2, 2007	Subprime lender New Century Financial Corp. files for bankruptcy	D02
Jul 10, 2007	Standard & Poor's says it may cut ratings on some \$12 billion of subprime debt	D03
Aug 10, 2007	Central banks around the world inject more cash into the international banking system as problems that began with US subprime mortgages rattle the global economy	D04
Aug 31, 2007	President Bush announces a limited bailout of US homeowners unable to pay the rising costs of their debts	D05
Sep 13, 2007	UK mortgage lender Northern Rock seeks financial support from the Bank of England; report sparks a run by worried depositors	D06
Oct 1, 2007	Swiss bank UBS says it will write down \$3.4 billion in its fixed-income portfolio; first quarterly loss in nine years	D07
Oct 15-17, 2007	A consortium of US banks backed by the US government announces a "super fund" of \$100 billion to purchase mortgage-backed securities whose mark-to-market value plummeted in the subprime collapse	D08
Oct 30, 2007	Merrill Lynch ousts Chairman and Chief Executive Stan O'Neal after reporting biggest quarterly loss in company's history	D09
Dec 12, 2007	Central banks coordinate the launch of the temporary Term Auction Facility (TAF) to address pressures in short-term funding markets	D10
Mar 11, 2008	Federal Reserve announces creation of Term Securities Lending Facility (TSLF)	D11
Mar 14-16, 2008	JP Morgan acquires Bear Stearns in rescue partially financed by Federal Reserve Bank of New York	D12
Jun 5, 2008	Standard & Poor's announces downgrade of mono line insurers AMBAC and MBIA	D13
Jul 11, 2008	Office of Thrift Supervision closes IndyMac Bank; Fourth-largest bank failure in US history	D14
Sep 7, 2008	Federal Housing Finance Agency places Fannie Mae and Freddie Mac in government conservatorship	D15
Sep 15-16, 2008	Bank of America announces purchase of Merrill Lynch; Lehman Brothers files Chapter 11 bankruptcy; Federal Reserve authorizes lending up to \$85 billion to AIG	D16
Oct 3, 2008	Congress passes <i>Emergency Economic Stabilization Act</i> establishing \$700 billion The Troubled Asset Relief Program (TARP).	D17
Nov 25, 2008	Federal Reserve Board announces creation of Term Asset-Backed Securities Lending Facility (TALF)	D18

Source: Adapted from Longstaff (2010).

Some events in the original table have been ignored. Each of D01 to D18 stands for a dummy variable that takes 1 on the event day and one day before, or zero otherwise.

Even though other subprime-related events occurred internationally during the subprime crisis period, we consider the 18 events reported in Table 1 to be the most relevant.

Relevant Canadian domestic events are reported in Table 2 below:

be the most relevant exchange rate for this study.

Table 2: Canadian events related to the mortgage crisis⁴

Date	Event(s)	Label
Feb 29, 2008	CIBC posts big first-quarter loss after taking pre-tax charges of C\$3.38 billion (\$3.47 billion)	CM1
May 29, 2008	CIBC reports a loss of \$1.1 billion for the second quarter ended April 30, 2008, compared with a profit of \$807 million a year earlier;	CM2
Aug 27, 2007	CIBC announces net income of \$71 million for the third quarter ended July 31, 2008	CM3
Oct 18, 2008	Announcement of the first phase of the Insured Mortgage Purchase Program (IMPP), covering purchases up to \$25 billion	CG1
Oct 23, 2008	Announcement of Canadian Lenders Assurance Facility (CLAF). It offers government insurance to cover loans of banks and other depository institutions, eligible for a maximum 3-year period	CG2
Aug 10, 2008	CIBC announces net income of \$436 million for the fourth quarter ended October 31, 2008	CM4
Feb 26, 2009	Announcement of the second phase of the Insured Mortgage Purchase Program (IMPP), covering purchases up to \$50 billion	CG3

Each of CM1, CM2, CM3 and CM4 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise. Similarly, each of CG1, CG2 and CG3 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise.

3.2 - Methodology

First, the three-factor model of bank stock returns (Choi, Elyasiani & Kopecky, 1992; Wetmore & Brick, 1994; Ryan and Worthington, 2004; Kasman, Vardar and Tunc, 2011) is used to revisit the relationship between Canadian banks stock returns and market, interest rate and exchange rate risks. It is specified as follows:

$$R_{it} = \beta_{0i} + \beta_{1i}R_{mt} + \beta_{2i}R_{rt} + \beta_{3i}R_{ft} + \varepsilon_{it}, \quad (1)$$

where R_{it} is the return on bank i equity at time t ; R_{mt} is the return on the market index at time t ; R_{rt} is the return on the interest rate index at time t ; R_{ft} is the return on the exchange rate index at time t ;

β_0 , β_1 , β_2 , β_3 are, respectively, the market, interest rate and exchange rate risk coefficients to be estimated; and ε_{it} is an error term.

There is potential multicollinearity among the variables on the right side in Equation (1). In order to solve this problem, earlier studies on bank sensitivity to interest rates and market returns have orthogonalized the variables. That is, interest rate returns are regressed on market returns, or vice versa, and

⁴ Once again, during the subprime crisis period, the quarterly result announcement date is an important event date, because the announced results can give an idea on the extent of write-offs related to US subprime assets. In this paper, we consider only CIBC's announcement dates (labelled CM1, CM2, CM3 and CM4). This bank was the Canadian bank most exposed to US subprime assets. It has recorded significant write-offs and has posted huge losses for the first and second quarters of 2008. We do not consider other banks' announcement dates because, as they have continued to post quarterly profits, the effect of the US subprime crisis may have been diluted by the fact that they have ultimately realized a profit.

the residuals from this auxiliary regression are then used in the two-index model. Giliberto (1985) and Kane and Unal (1988), among others, have pointed out the potential bias in this procedure. Furthermore, other studies have suggested that differences between the orthogonalized and the unorthogonalized results are statistically insignificant (Neuberger, 1994). Following Giliberto (1985) and Kane and Unal (1988), this article employs an unorthogonalized three-factor model.

A second issue is the use of realized versus unanticipated changes in interest rate and exchange rate returns. Atindehou and Gueyie (2001) have found that Canadian banks' returns were sensitive to both realized and unanticipated interest and exchange rate changes over the period 1988-1995. In this paper, we have used unanticipated interest and exchange rates. We proxy unanticipated interest rates as the difference between the returns on 10-year (long-term) government bonds and one-month Treasury bills.⁵ For unanticipated changes in foreign exchange rates, the expected exchange rate series is estimated using an AR1-GARCH(1,1) model.

Next, Equation (1) is extended to allow us to assess the impact of relevant events (Atindehou & Gueyie, 2001). It is described as follows: where the new variable D_{kt} is a dummy variable that takes the value of 1 on the

$$R_{it} = \beta_{0i} + \beta_{1i}R_{mt} + \beta_{2i}R_{rt} + \beta_{3i}R_{ft} + \sum_{k=1}^n \beta_{(k+3)i}D_{kt} + \varepsilon_{it}, \quad (2)$$

event day and one day before, or zero otherwise, and D_{kt} will either be D_{01} to D_{18} for US/International events or CM1, CM2, CM3, CM4, CG1, CG2 and CG3 for Canadian domestic events (refer to Tables 1 and 2 for event descriptions). Coefficients β_j ($j = 4$ to n) are announcement impact coefficients to be estimated.

In Equation (1) and Equation (2), coefficients are jointly estimated for all banks using the Seemingly Unrelated Regression (SUR) approach. All estimates within the text are made using Stata software.

⁵ Kane and Unal (1988) use unadjusted returns on long-term government bonds to proxy the unanticipated changes in the interest-rate index.

4 - Results and discussion

4.1 - Descriptive statistics

Table 3 reports descriptive statistics on banks' stock, market, interest rate and Canada/US exchange rate returns.

Table 3: Descriptive statistics on returns

Variable	Mean	Std Dev	Min	Max	Skew.	Kurt.
Bank of Montreal	0.00045	0.01552	-0.12016	0.09651	0.12251	9.39018
Bank of Nova Scotia	0.00065	0.01522	-0.12834	0.12132	0.11352	12.63708
CIBC	0.00061	0.01716	-0.12311	0.11379	0.26019	9.99558
National Bank	0.00065	0.01580	-0.14340	0.13586	0.19426	15.05156
Royal Bank	0.00055	0.01583	-0.13395	0.14102	0.52250	14.90000
TD Bank	0.00063	0.01521	-0.13113	0.12047	0.35031	12.62864
Financial Service Index	0.00041	0.01377	-0.12798	0.11388	-0.05546	17.83780
Market index	0.00045	0.01243	-0.09763	0.09373	-0.76620	13.90169
10-year GofC bond	-0.00013	0.12790	-0.07850	0.06838	-0.02939	5.912802
1-month T-bill	0.00127	0.06177	-0.39130	0.89231	3.19695	50.75544
10yGCB – 1mo T-bill	-0.00136	0.06164	-0.88439	0.39824	-2.9227	47.48694
Canada/US FX rate	-0.00021	0.00669	-0.04498	0.03418	0.19206	6.105364
Unexpected FX rate	0.00009	0.00669	-0.04474	0.03456	0.19473	6.138971

The average daily stock returns vary from 0.045% for Bank of Montreal to 0.065% for National Bank and Bank of Nova Scotia. It is positive for the financial service industry index (0.041%), the market (0.045%), and the short-term interest rate (0.127%), but negative for 10-year government bonds (-0.013%) and the exchange rate (-0.021%). On average, the Canadian dollar has appreciated against the US dollar during the study period. Volatility, as measured by the standard deviation of returns, is lower for the exchange rate (0.669%) compared to that of the interest rate (6.177%). Skewness and kurtosis statistics are generally significant. Thus, returns are not normally distributed.

As can be seen in Table 4, correlations between the market and exchange and interest rates are not too high, eliminating the possibility of multicollinearity among these independent factors used to explain banks' stock returns.

Table 4: Correlation matrix between market, exchange rate and interest rates returns

	Market index	Interest rate	Unexpected FX rate
Market index	1		
Interest rate**	-0.0836	1	
Unexpected FX rate	-0.3556	0.0150	1

(**) Interest rate = (10yGCB – 1mo T-bill)

4.2 - Market, interest rate and exchange rate sensitivities of Canadian banks stock returns

We started our investigation by re-examining the relationship between market, interest rate and exchange rate, and Canadian banks' stock returns. Results are reported in Table 5.

The relation between banks' stock returns and market index returns is positive. It is significant for all banks and for the Financial Services Index at 1% level. This corroborates the traditional view that market index is a key determinant of stock returns. The interest rate is negatively related to all banks' stock returns and the Financial Services Index, and is significant at 1% level for Bank of Montreal, 5% level for Royal Bank, Toronto Dominion Bank and the Financial Services Index, and at 10% level for the National Bank. With the exception of Toronto Dominion Bank and the Financial Services Index, the exchange rate is negatively related to banks' returns and significant for Bank of Montreal, Bank of Nova Scotia and CIBC at 10%, 5% and 10% levels, respectively. This means that a depreciation of the Canadian dollar relative to the US dollar has a negative impact on Canadian banks' returns.

Table 5: Market, interest rate and foreign exchange rate sensitivities of banks' stocks returns

$$R_{it} = \beta_{0i} + \beta_{1i}R_{mt} + \beta_{2i}R_{rt} + \beta_{3i}R_{ft} + \varepsilon_{it}$$

	β_0	β_1	β_2	β_3	R^2
Bank of Montreal	8.31e-05 (0.291)	0.697*** (28.260)	-0.0131 *** (-2.837)	-0.0799* (-1.753)	0.331
Bank of Nova Scotia	0.000295 (1.131)	0.772*** (34.240)	-0.00693 (-1.638)	-0.0894** (-2.147)	0.417
National Bank	0.000334 (1.113)	0.671*** (25.870)	-0.00909* (-1.867)	-0.0255 (-0.531)	0.285
Royal Bank	0.000184 (0.674)	0.799*** (33.810)	-0.0100** (-2.283)	-0.0487 (-1.115)	0.407
CIBC	0.000255 (0.830)	0.813*** (30.580)	-0.00495 (-0.992)	-0.0839* (-1.709)	0.362
TD Bank	0.000231 (0.887)	0.800*** (35.490)	-0.0102** (2.422)	0.0846** (2.031)	0.416
Financial Services Index	-8.41e-06 (-0.045)	0.889*** (55.010)	-0.00719** (-2.370)	0.0520* (1.742)	0.633

Notes: T-statistics in parentheses; Significance: *** = 1%; ** = 5% and * = 10% levels; In this regression model, R_m is the return on the market index, represented by the Toronto stock index. R_r is the unanticipated return on interest rate, approximated by the difference between 10-year government bond returns and one-month treasury bill returns. R_f is the unanticipated return on the Canada/US exchange rate. The expected component of this rate is estimated by an ARI-GARCH(1,1) model.

4.3 - Canadian banks' reaction to US/International subprime events

Table 6 reports the reaction of Canadian banks to US/International subprime events. Here, we estimated Equation (2), retaining only US/International subprime events.

One notices that US/International subprime events have effectively impacted Canadian banks' stock returns. However, the global Canadian banks' reaction (i.e., the news that has jointly affected all of banks at the same time) did not appear before March 14-16 2008 (see the coefficient of D12). This was the date when JP Morgan acquired Bear Stearns (March 16), after the Federal Reserve Bank of New York provided an emergency loan to the latter (on March 14) to avert its sudden collapse. The impact of this news was negative for all banks, and significant for all but Toronto Dominion Bank.

Before the March 14-16, 2008 news, only CIBC and Toronto Dominion Bank negatively reacted to event number 4 (see the coefficient of D04). That day (August 10, 2007), central banks around the world were injecting cash into the international banking system. Canada's central bank participation in this action [C\$1.64bn (US\$1.5bn) into the money market against €94.8bn from the European Central Bank into the euro money market; US\$24bn of US Federal Reserve temporary reserves into the US banking system; and 1 trillion yen (US\$8.39bn) from the Bank of Japan into the Japanese money market] could have been interpreted by Canadian investors as marginal.

The National Bank was the only other Canadian bank that reacted to US/International subprime events before March 14-16, 2008. It recorded a negative and significant reaction to "President Bush announces a limited bailout of US homeowners unable to pay the rising costs of their debts" (see the coefficient of D05) and to "A consortium of US banks backed by the US government announces a super fund of \$100 billion to purchase mortgage-backed securities..." (see the coefficient of D08), but positively to "Merrill Lynch ousts Chairman and Chief Executive Stan O'Neal after reporting biggest quarterly loss in company's history" (see the coefficient of D09).

Taken together, these results are in accordance with Dooley and Hutchison's (2009) finding that emerging markets were relatively decoupled from the US market in phase 1 of the subprime crisis. This also seems to be the case for Canadian banks.

Canadian banks jointly negatively reacted to the March 14-16, 2008 event (Bear Stearns' acquisition by JP Morgan; see D12). We interpret this as a fear at that time by Canadian bank investors that, while these banks had been solid relative to many US banks in the face of the subprime crisis and

had gone through the devastating 2007 year relatively well, the danger of contagion resulting from further big US bank failures was not over. In other words, this reaction reflects investors' fear that potential serious banking problems were not behind them. This interpretation is confirmed by the negative and significant reaction of all Canadian banks to the closure by the US Office of Thrift Supervision of IndyMac Bank on July 11, 2008 (see D14). It was the fourth-largest bank failure in US history.

Surprisingly, the September 15-16 events that we regard as major events in the subprime crisis ("Bank of America announces purchase of Merrill Lynch; Lehman Brothers files Chapter 11 bankruptcy; Federal Reserve authorizes lending up to \$85 billion to AIG"; see D16) had no significant impact on Canadian banks' stock returns. This shows us that the fear lasted for a relatively short period.

Globally speaking, Canadian banks' stock returns have positively reacted to US good news in the US in late 2008. The D15 variable coefficient, which is the coefficient of the September 7, 2008 event "Federal Housing Finance Agency places Fannie Mae and Freddie Mac in government conservatorship," is positive for all banks, and significant for four of them (Bank of Montreal, National Bank, CIBC, and Toronto Dominion Bank). The conservatorship action and commitment by the US government to back these two government-sponsored enterprises with up to US\$ 200 billion in additional capital could have been interpreted as an implicit bailout of these entities, and then, as a backup to the structured assets that they have issued. D17 of October 03, 2008 refers to "US Congress passes *Emergency Economic Stabilization Act* establishing \$700 billion The Troubled Asset Relief Program (TARP)", and D18 of November 25, 2008 states that "Federal Reserve Board announces creation of Term Asset-Backed Securities Lending Facility (TALF)". These two programs, aimed at helping US firms (including banks) to manage their troubled assets, could at the end help Canadian banks dealing with US asset-backed securities. When significant (9 cases of 12), D17 and D18 coefficients are positive in all but one case.

Table 6: Canadian banks' reactions to US/International subprime events

$$R_{it} = \beta_{0i} + \beta_{1i}R_{mt} + \beta_{2i}R_{rt} + \beta_{3i}R_{ft} + \sum_{k=1}^{18} \beta_{(k+3)i}D_{kt} + \varepsilon_{it}$$

Coefficients	Bank of Montreal		Bank of Nova Scotia		National Bank		Royal Bank		CIBC		TD Bank	
β_0	0.000113 (0.394)	0.000288 (1.103)	0.000289 (0.971)	0.000216 (0.791)	0.000338 (1.103)	0.000294 (1.127)						
β_1	0.696*** (28.19)	0.774*** (34.30)	0.677*** (26.32)	0.801*** (33.90)	0.818*** (30.89)	0.804*** (35.67)						
β_2	-0.0126*** (-2.741)	-0.00675 (-1.605)	-0.00866* (-1.807)	-0.00976** (-2.215)	-0.00440 (-0.891)	-0.0101** (-2.395)						
β_3	-0.0686 (-1.507)	-0.0824** (-1.982)	-0.000764 (-0.0161)	-0.0380 (-0.873)	-0.0810* (-1.660)	0.0776* (1.871)						
β_4 [D01]	0.00409 (0.457)	-0.000239 (-0.0293)	0.00203 (0.218)	0.00156 (0.182)	-0.000739 (-0.0771)	0.00102 (0.125)						
β_5 [D02]	-0.00373 (-0.417)	-0.00400 (-0.490)	0.00397 (0.427)	-0.00481 (-0.562)	-7.82e-05 (-0.00816)	-0.00392 (-0.481)						
β_6 [D03]	0.000549 (0.0613)	0.000430 (0.0526)	-0.00327 (-0.352)	-0.00407 (-0.475)	-0.00487 (-0.508)	-0.00321 (-0.393)						
β_7 [D04]	-0.00699 (-0.782)	-0.0130 (-1.592)	-0.00643 (-0.690)	-0.00512 (-0.599)	-0.00425 (-0.426)	-0.0165** (-2.024)						
β_8 [D05]	-0.00697 (-0.779)	0.00291 (0.356)	-0.0207** (-2.220)	-0.00425 (-0.496)	0.00347 (0.362)	-0.00425 (-0.521)						
β_9 [D06]	-0.00854 (-0.955)	-0.00508 (-0.621)	0.00877 (0.942)	-0.0117 (-1.367)	-0.00160 (-0.167)	0.000610 (0.0749)						
β_{10} [D07]	0.0147	0.00384	0.00886	0.00733	0.00408	0.00119						

β_{11} [D08]	(1.160)	(0.332)	(0.673)	(0.606)	(0.301)	(0.104)
	-0.00710	-0.00118	-0.0133*	-0.00817	-0.0128	-0.0106
	(-0.972)	(-0.177)	(-1.751)	(-1.170)	(-1.633)	(-1.593)
β_{12} [D09]	0.0125	0.00927	0.0181*	0.00495	0.00927	0.00922
	(1.401)	(1.134)	(1.945)	(0.578)	(0.967)	(1.131)
β_{13} [D10]	0.00549	4.95e-06	0.00344	-0.00424	-0.00540	-0.00278
	(0.613)	(0.000606)	(0.370)	(-0.495)	(-0.563)	(-0.341)
β_{14} [D11]	-0.0142	0.000273	0.0132	0.00969	-0.00507	0.00558
	(-1.589)	(0.0334)	(1.423)	(1.133)	(-0.529)	(0.685)
β_{15} [D12]	-0.0183**	-0.0165**	-0.0214**	-0.0164*	-0.0230**	-0.0105
	(-2.040)	(-2.013)	(-2.292)	(-1.915)	(-2.397)	(-1.285)
β_{16} [D13]	0.000343	0.00900	-0.00682	-0.00484	-0.0154	-0.00423
	(0.0384)	(1.101)	(-0.733)	(-0.566)	(-1.602)	(-0.519)
β_{17} [D14]	-0.0180**	-0.0173**	-0.0248***	-0.0224***	-0.0293***	-0.0237***
	(-2.018)	(-2.119)	(-2.663)	(-2.614)	(-3.056)	(-2.905)
β_{18} [D15]	0.0257**	0.0127	0.0499***	0.0165	0.0478***	0.0338***
	(2.031)	(1.096)	(3.788)	(1.363)	(3.526)	(2.933)
β_{19} [D16]	-0.00106	-0.00392	0.00395	-0.0110	-0.0143	0.00333
	(-0.118)	(-0.480)	(0.424)	(-1.286)	(-1.488)	(0.408)
β_{20} [D17]	-0.00195	0.0215***	0.0163*	0.0176**	0.0228**	0.00657
	(-0.217)	(2.622)	(1.739)	(2.043)	(2.363)	(0.802)
β_{21} [D18]	0.0177**	0.0155*	0.0446***	0.0215**	-0.00795	-0.0221***
	(1.972)	(1.883)	(4.765)	(2.506)	(-0.825)	(-2.696)
Observations	1,996	1,996	1,996	1,996	1,996	1,996
R ²	0.340	0.425	0.309	0.416	0.376	0.426

Notes: Standard errors in parentheses; Significance: *** = 1%; ** = 5% and * = 10% levels; In this regression model, R_m is the return on the market index, represented by the Toronto stock index. R_f is the unanticipated return on interest rate, approximated by the difference between 10-year government bond returns and one-month treasury bill returns. R_f is the unanticipated return on the Canada/US exchange rate. The expected component of this rate is estimated by an AR1-GARCH(1,1) model; Coefficients are estimated using Seemingly Unrelated Regressions; Each of D01 to D018 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise.

4.4 - Banks' reaction to selected Canadian domestic news⁶

Table 7 reports the reaction of Canadian banks' stock returns to selected Canadian domestic events related to mortgages and the US subprime crisis.

The variable CM1 coefficient tells us how bank returns have reacted to the disclosure by CIBC —the Canadian bank most exposed to toxic US subprime assets— of its 2008 first-quarter results, a loss of C\$1.46 billion that includes more than C\$2.9 billion in write downs, mainly related to the US debt-market turmoil. While it is negative for all banks, it is significant only for Bank of Montreal and the National Bank. Even CIBC itself did not significantly react to this event. This is a very moderate reaction that, according to the authors of this study, reflects the market belief (confidence) that the subprime crisis would not hit Canadian banks very hard. Even the second quarter CIBC disclosure of a C\$1.11 billion loss (variable CM2) just marginally affected CIBC itself negatively (at 10% level), but not the other banks. Fourth-quarter disclosure of a C\$436 million profit (variable CM4) generally positively affected banks' returns (with the exception of the National Bank of Canada).

Despite their exposure to US toxic mortgage assets, Canadian banks, as illustrated by the case of CIBC, seem to have properly managed the related risks. CIBC had taken several measures to counter the impact of large losses, including selling its US investment banking operations to Oppenheimer Holdings; entering a deal with Cerberus to limit US residential exposure, and issuing new equity shares.

We completed the study by analyzing the reaction of Canadian banks' stock to the Government of Canada measures aimed at providing (during the global crisis) liquidity to banks and temporarily insuring their borrowings on financial markets. While the market reacted timidly to the first Insured Mortgage Purchase Program (IMPP) announcement of C\$25 billion on October 18, 2008 (see the CG1 coefficient), the effects of the Canadian Lenders Assurance Facility (CLAF) announcement on October 23 (see CG2) and the second IMPP announcement of C\$50 billion on February 26, 2009 (See CG3) were largely positive and significant.

⁶ See the Table 2 footnote.

Table 7: Canadian banks' reactions to selected Canadian domestic events related to the subprime crisis

$$R_{it} = \beta_{0i} + \beta_{1i}R_{mt} + \beta_{2i}R_{nt} + \beta_{3i}R_{ft} + \sum_{k=19}^{25} \beta_{(k+3)i}D_{kt} + \varepsilon_{it}$$

Coefficient	Bank of Montreal	Bank of Nova Scotia	National Bank	Royal Bank	CIBC	TD Bank
β_0	5.50e-06 (0.0195)	0.000291 (1.128)	0.000290 (0.981)	0.000130 (0.478)	0.000214 (0.698)	0.000175 (0.671)
β_1	0.701*** (28.47)	0.761*** (33.86)	0.659*** (25.56)	0.793*** (33.47)	0.806*** (30.21)	0.800*** (35.25)
β_2	-0.0107** (-2.307)	-0.00811* (-1.909)	-0.00976** (-2.004)	-0.0101** (-2.248)	-0.00557 (-1.104)	-0.00988** (-2.302)
β_3	-0.108** (-2.384)	-0.0851** (-2.055)	-0.0398 (-0.838)	-0.0616 (-1.413)	-0.0962* (-1.957)	0.0712* (1.704)
β_{22} [CM1]	-0.0336*** (-3.776)	-0.0111 (-1.364)	-0.0205** (-2.198)	-0.00495 (-0.579)	-0.00875 (-0.908)	-0.00838 (-1.022)
β_{23} [CM2]	0.00649 (0.730)	0.0180** (2.213)	0.0102 (1.094)	0.0119 (1.391)	-0.0169* (-1.750)	0.00913 (1.115)
β_{24} [CM3]	0.0102 (1.144)	-0.00877 (-1.080)	0.00394 (0.424)	-0.00594 (-0.694)	0.0122 (1.270)	0.00246 (0.300)
β_{25} [CM4]	0.00987 (1.108)	0.0109 (1.336)	-0.0305*** (-3.276)	0.00186 (0.216)	0.0215** (2.231)	0.0151* (1.843)
β_{26} [CG1]	0.0248*** (2.709)	-0.00327 (-0.391)	-0.00411 (-0.429)	0.00245 (0.277)	-0.00359 (-0.362)	0.00363 (0.430)

β_{27} [CG2]	0.0316*** (3.534)	-0.0368*** (-4.514)	0.0291*** (3.112)	0.00981 (1.141)	0.00347 (0.359)	0.0153* (1.856)
B_{28} [CG3]	0.0324*** (3.639)	0.0380*** (4.676)	0.0624*** (6.687)	0.0426*** (4.966)	0.0366*** (3.794)	0.0208*** (2.530)
Observatio ns	1,996	1,996	1,996	1,996	1,996	1,996
R^2	0.347	0.432	0.310	0.415	0.370	0.420

Notes: Standard errors in parentheses; Significance: *** = 1%; ** = 5% and * = 10% levels; In this regression model, R_m is the return on the market index, represented by the Toronto stock index. R_t is the unanticipated return on interest rate, approximated by the difference between 1-year government bond returns and one-month treasury bill returns. R_f is the unanticipated return on the Canada/US exchange rate; The expected component of this rate is estimated by an AR1-GARCH(1,1) model; Each of CM1, CM2, CM3 and CM4 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise. Similarly, each of CG1, CG2 and CG3 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise; Coefficients are estimated using Seemingly Unrelated Regressions.

The Canadian government seems to have successfully helped the Canadian banking sector survive the crisis. We recall that by buying back Canadian financial institutions' insured mortgages (and thus providing them cash), the purpose of the IMPP was to help those institutions raise longer-term funds and to use these funds to make new loans available to consumers, home buyers and businesses in Canada. In the same way, the aim of the CLAF was to offer insurance on the wholesale term borrowing of federally regulated deposit-taking institutions to ensure they would not be at a competitive disadvantage when raising funds in wholesale markets.

4.5 - Robustness check

Table 8 re-estimates the Equation (2), but with all events included in the regression. A closer look shows us that our previous findings on Canadian banks reaction to US/International subprime events are materially unchanged.

Table 8: Canadian banks' reactions to subprime crisis events (all events considered)

$$R_{it} = \beta_0 + \beta_1 R_{mt} + \beta_2 R_{rt} + \beta_3 R_{ft} + \sum_{k=1}^n \beta_{(k+3)i} D_{kt} + \varepsilon_{it}$$

Coefficients	Bank of Montreal	Bank of Nova Scotia	National Bank	Royal Bank	CIBC	TD Bank
β_0	3.44e-05 (0.121)	0.000285 (1.101)	0.000245 (0.837)	0.000162 (0.595)	0.000296 (0.970)	0.000236 (0.907)
β_1	0.700*** (28.39)	0.763*** (33.90)	0.664*** (26.01)	0.796*** (33.55)	0.811*** (30.51)	0.803*** (35.43)
β_2	-0.0103** (-2.215)	-0.00793* (-1.877)	-0.00935* (-1.952)	-0.00981** (-2.204)	-0.00499 (-1.000)	-0.00965** (-2.267)
β_3	-0.0969** (-2.140)	-0.0779* (-1.885)	-0.0149 (-0.318)	-0.0509 (-1.169)	-0.0934* (-1.913)	0.0639 (1.535)
β_4 [D01]	0.00422 (0.478)	-0.000258 (-0.0320)	0.00207 (0.227)	0.00163 (0.191)	-0.000691 (-0.0726)	0.00110 (0.135)
β_5 [D02]	-0.00368 (-0.416)	-0.00399 (-0.495)	0.00402 (0.439)	-0.00476 (-0.560)	-3.99e-05 (-0.00420)	-0.00387 (-0.477)
β_6 [D03]	0.000705 (0.0798)	0.000412 (0.0511)	-0.00321 (-0.352)	-0.00399 (-0.470)	-0.00482 (-0.506)	-0.00312 (-0.384)
β_7 [D04]	-0.00681 (-0.771)	-0.0131 (-1.628)	-0.00649 (-0.709)	-0.00509 (-0.600)	-0.0194** (-2.039)	-0.0164** (-2.021)
β_8 [D05]	-0.00693 (-0.784)	0.00298 (0.369)	-0.0206** (-2.251)	-0.00418 (-0.492)	0.00352 (0.370)	-0.00421 (-0.518)
β_9 [D06]	-0.00857 (-0.970)	-0.00501 (-0.622)	0.00881 (0.964)	-0.0117 (-1.373)	-0.00158 (-0.166)	0.000618 (0.0761)

β_{10} [D07]	0.0146 (1.171)	0.00394 (0.346)	0.00895 (0.693)	0.00738 (0.615)	0.00414 (0.307)	0.00121 (0.105)
β_{11} [D08]	-0.00703 (-0.974)	-0.00115 (-0.175)	-0.0132* (-1.775)	-0.00811 (-1.169)	-0.0127 (-1.637)	-0.0106 (-1.591)
β_{12} [D09]	0.0125 (1.415)	0.00929 (1.152)	0.0181** (1.979)	0.00495 (0.582)	0.00926 (0.972)	0.00922 (1.135)
β_{13} [D10]	0.00566 (0.641)	-4.40e-05 (-0.00546)	0.00349 (0.382)	-0.00416 (-0.490)	-0.00533 (-0.560)	-0.00268 (-0.330)
β_{14} [D11]	-0.0141 (-1.599)	0.000312 (0.0387)	0.0134 (1.462)	0.00979 (1.152)	-0.00498 (-0.523)	0.00566 (0.697)
β_{15} [D12]	-0.0181** (-2.045)	-0.0166** (-2.057)	-0.0214** (-2.339)	-0.0164* (-1.924)	-0.0230** (-2.407)	-0.0104 (-1.275)
β_{16} [D13]	0.000471 (0.0533)	0.00911 (1.129)	-0.00658 (-0.719)	-0.00467 (-0.550)	-0.0152 (-1.594)	-0.00411 (-0.506)
β_{17} [D14]	-0.0180** (-2.042)	-0.0172** (-2.139)	-0.0247*** (-2.701)	-0.0223*** (-2.625)	-0.0292*** (-3.069)	-0.0236*** (-2.911)
β_{18} [D15]	0.0259** (2.070)	0.0125 (1.096)	0.0498*** (3.848)	0.0165 (1.372)	0.0478*** (3.546)	0.0339*** (2.951)
β_{19} [D16]	-0.000830 (-0.0938)	-0.00415 (-0.514)	0.00379 (0.414)	-0.0110 (-1.297)	-0.0143 (-1.502)	0.00344 (0.422)
β_{20} [D17]	-0.00157 (-0.177)	0.0211*** (2.604)	0.0160* (1.737)	0.0175** (2.051)	0.0227** (2.369)	0.00673 (0.824)
β_{21} [D18]	0.0172* (1.937)	0.0157* (1.941)	0.0445*** (4.849)	0.0214** (2.511)	-0.00805 (-0.842)	-0.0223*** (-2.732)
β_{22} [CM1]	0.0246*** (2.705)	-0.00328 (-0.395)	-0.00430 (-0.456)	0.00233 (0.267)	-0.00329 (-0.335)	0.00402 (0.480)
β_{23} [CM2]	0.0313***	-0.0369***	0.0288***	0.00965	0.00349	0.0155*

β_{24} [CM3]	(3.531) 0.0324***	(-4.552) 0.0380***	(3.139) 0.0622***	(1.131) 0.0425***	(0.365) 0.0364***	(1.894) 0.0207**
β_{25} [CM4]	(3.654) -0.0336***	(4.698) -0.0111	(6.786) -0.0204**	(4.990) -0.00499	(3.817) -0.00880	(2.540) -0.00840
β_{26} [CG1]	(-3.807) 0.00648	(-1.372) 0.0180**	(-2.234) 0.0103	(-0.588) 0.0119	(-0.924) -0.0170*	(-1.034) 0.00905
β_{27} [CG2]	(0.734) 0.0102	(2.230) -0.00877	(1.122) 0.00398	(1.400) -0.00598	(-1.780) 0.0121	(1.115) 0.00236
B_{28} [CG3]	(1.152) 0.00971	(-1.088) 0.0108	(0.436) -0.0307***	(-0.704) 0.00174	(1.273) 0.0215**	(0.290) 0.0152*
	(1.097)	(1.340)	(-3.349)	(0.204)	(2.254)	(1.870)
Observations	1,996	1,996	1,996	1,996	1,996	1,996
R ²	0.356	0.440	0.334	0.424	0.384	0.431

Notes: Standard errors in parentheses; Significance: *** = 1%; ** = 5% and * = 10% levels; In this regression model, R_m is the return on the market index, represented by the Toronto stock index. R_t is the unanticipated return on interest rate, approximated by the difference between 10-year government bond returns and one-month treasury bill returns. R_t is the unanticipated return on the Canada/US exchange rate; The expected component of this rate is estimated by an AR1-GARCH(1,1) model; Each of D01 to D018 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise; Each of CM1, CM2, CM3 and CM4 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise. Similarly, each of CG1, CG2 and CG3 is a dummy variable that takes 1 on the event day and one day before, or zero otherwise; Coefficients are estimated using Seemingly Unrelated Regressions.

5 – Conclusion

The goal of this paper was to analyze the reaction of Canadian banks' stocks to the US subprime crisis and to some Canadian events closely related to the crisis. Dealing with the effect of the same crisis on 14 emerging markets, Dooley and Hutchison (2009) found that over phase 1 of the crisis [February 2007 to May 19, 2008], "investors [in emerging markets] did not expect the financial difficulties unfolding in the US and Europe to have a negative impact on dollar earnings in emerging markets nor did they apply a higher discount rate to those earnings". Our results extend this conclusion to the whole subprime crisis for Canadian banks. As shown by the CIBC case —the Canadian bank most exposed to toxic US subprime assets— despite the exposure to US subprime mortgage-backed assets, Canadian banks have managed their exposure very well, discarding any risk of failure.

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