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## Why Are Canadian Banks More Resilient?

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## **IMF Working Paper**

Western Hemisphere Department

### **Why Are Canadian Banks More Resilient?<sup>1</sup>**

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#### **Abstract**

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This paper explores factors behind Canadian banks' relative resilience in the credit turmoil. We identify two main causes: a higher share of depository funding (vs. wholesale funding) in liabilities, and a number of regulatory and structural factors in the Canadian market that reduced banks' incentives to take excessive risks. The robust predictive power of the depository funding ratio is confirmed in a multivariate analysis of the performance of 72 largest commercial banks in OECD countries during the turmoil.

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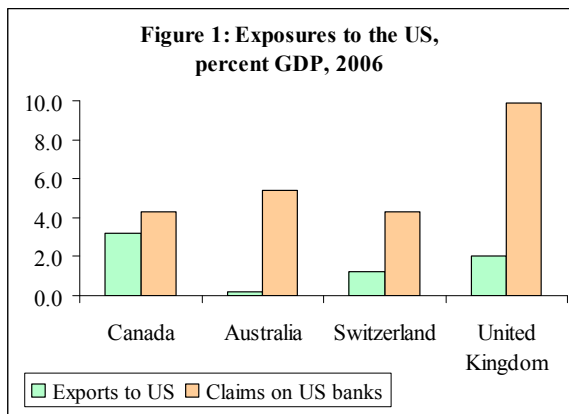
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## I. INTRODUCTION

The credit turmoil that started in 2007 and intensified in 2008 imposed significant strains on banks around the world. As the major disruptions took place in markets for complex assets and wholesale funding, many countries with sophisticated financial systems (such as most OECD members) were particularly exposed. The impacts of the turmoil extended well beyond the financial sector. Countries with severe banking sector problems experienced spillovers to the real sector from a credit crunch, fiscal shortfalls due to reduced tax bases, and sometimes balance of payment problems associated with capital outflows. The linkages between the financial sector and the real economy created often-significant feedback loops (Bayoumi and Melander, 2008).



Sources: BIS, Haver Analytics

The impact of the credit turmoil on Canada appeared serious but clearly mild in comparison with a number of other OECD countries. Funding conditions of Canadian banks deteriorated and their profitability declined, but not as severely as elsewhere. Public bank recapitalizations were not needed, and government guarantees on bank funding (put in place for precautionary reasons) were not drawn upon. This resilience may appear somewhat surprising given the

high exposure of the Canadian economy to the U.S. economy, and highlights the fundamental strengths of Canadian banks.

The aim of this paper is to understand the key sources of Canada's resilience to the ongoing turmoil. This task has important policy implications. First, it would allow an assessment of the risks to Canadian banks going forward. Second, understanding the sources of resilience would be useful for countries that may seek to learn from Canada's experience.

The paper consists of two parts. The first part (Section 2) analyzes **pre-crisis fundamentals** of Canadian banks and compares them to those of their OECD peers. We track the impact of three structural balance sheet fundamentals—capital, liquidity, and deposit ratios—on banks' future performance during the crisis, captured by a number of objective and subjective measures, e.g. equity price decline and the need for significant government assistance.

Reviewing the data, we note that the pre-crisis capital and liquidity ratios of Canadian banks were not exceptionally strong relative to their peers in other OECD countries. However, Canadian banks clearly stood out in terms of *funding structure*: they relied much less on wholesale funding, and much more on depository funding, much of which came from retail sources such as households. We posit that the funding structure of Canadian banks was the key determinant of their resilience during the turmoil.

Multivariate regression analysis confirms our initial hypotheses. Based on a sample of all large commercial banks in OECD countries, we find that funding structure was the most robust predictor of bank performance during the turmoil – banks with more depository funding experienced smaller equity price declines and a lower probability of government assistance due to financial distress. Although bank capital ratio taken by itself was not a robust predictor of resilience, a more specific dummy variable capturing critically low (under 4 percent) capital was a significant predictor of sharp equity declines and probability of government assistance. Low balance sheet liquidity did well in predicting extreme stress.

The second part of this paper (Section 3) reviews **regulatory and structural factors** that may have reduced Canadian banks' incentives to take risks and contributed to their relative resilience during the turmoil. We identify a number of them: stringent capital regulation with higher-than-Basel minimal requirements, limited involvement of Canadian banks in foreign and wholesale activities, valuable franchises, and a conservative mortgage product market.

## II. FUNDAMENTALS OF CANADIAN BANKS

### A. Bank Fundamentals and Peer Comparison

This section analyzes the pre-crisis balance sheet structures of Canadian banks, compares them with commercial banks in other OECD countries, and assesses which fundamentals have contributed to the resilience of Canadian banks during the ongoing turmoil. For the exercise, we use BankScope data for end-2006 to capture conditions prior to the start of the crisis in mid-2007. We focus on three measures:

- **Capital ratios:** Better-capitalized banks are able to sustain higher losses without becoming insolvent, and can maintain access to funding in the midst of market uncertainty about their asset values.
- **Balance sheet liquidity:** A buffer of liquid assets allows banks to cover transitory cash-flow shortfalls during idiosyncratic or market-wide funding disruptions.

- **Funding structure:** Retail deposits are the most ‘sticky’ source of bank funding since they are covered by deposit insurance (Feldman and Schmidt, 2001). Interbank depositors are relatively informed and less likely to withdraw from fundamentally sound banks (Rochet and Tirole, 1996). By contrast, money market wholesale funding is often uninformed and may ‘run’ based on mild negative news or rumors (Huang and Ratnovski, 2008).

We assess the impact of these ex-ante fundamentals on bank performance during the crisis. We use three objective and subjective measures of performance.

The first is the equity price decline from January 2007 to January 2009, which is an all-in summary measure of value destruction during the turmoil, resulting from credit losses, writedown on securities, and dilution from new equity issuances including government capital injections. In our context, equity price decline is more appropriate a performance measure than distance-to-default or Z-scores used in for example Cihak and Hesse (2007), because banks’ ex-post actions of delivering, recapitalization, and risk reduction all can increase distance-to-default or increase z-scores, covering up mass value destruction during the crisis.

The second (pair) of measures are two dummy variables identifying whether that decline was greater than the median (70 percent) or extraordinarily large (85 to 100 percent), respectively.

The third measure of performance is a dummy capturing the degree of government intervention that a bank required during the turmoil: whether it was used to avoid extreme stress or to address a less dire weakness.

The three measures of performance are complementary, reducing arbitrariness of the choices of measures and increasing robustness of the results. Measures based on equity prices are quantitatively objective, yet equity prices themselves can be distorted by mispricing or the effects of government intervention. The measure based on the degree of government intervention is partly judgmental, but represents an intuitive classification of the degree of banks’ stress.

**Table 1. Subsample of banks**

|  |                |
|--|----------------|
| Australia and New Zealand Banking Group        | AUSTRALIA      |
| Commonwealth Bank of Australia                 | AUSTRALIA      |
| National Australia Bank                        | AUSTRALIA      |
| Westpac Banking Corporation                    | AUSTRALIA      |
| <b>Bank of Nova Scotia (The) - SCOTIABANK</b>  | <b>CANADA</b>  |
| <b>Banque de Montreal-Bank of Montreal</b>     | <b>CANADA</b>  |
| <b>Canadian Imperial Bank of Commerce CIBC</b> | <b>CANADA</b>  |
| <b>Royal Bank of Canada RBC</b>                | <b>CANADA</b>  |
| <b>Toronto Dominion Bank</b>                   | <b>CANADA</b>  |
| Credit Suisse Group                            | SWITZERLAND    |
| UBS AG   | SWITZERLAND    |
| Barclays Plc                                   | UNITED KINGDOM |
| HBOS Plc                                       | UNITED KINGDOM |
| HSBC Holdings Plc                              | UNITED KINGDOM |
| Lloyds TSB Group Plc                           | UNITED KINGDOM |
| Northern Rock Plc                              | UNITED KINGDOM |
| Royal Bank of Scotland Group Plc (The)         | UNITED KINGDOM |
| Bank of America Corporation                    | USA            |
| Capital One Financial Corporation              | USA            |
| Citigroup Inc                                  | USA            |
| JP Morgan Chase & Co.                          | USA            |
| Wachovia Corporation                           | USA            |
| Washington Mutual Inc.                         | USA            |
| Wells Fargo & Company                          | USA            |

We analyze fundamentals and performance of Canadian banks against a sample of major commercial banks in other OECD countries. In total we have 72 banks with assets exceeding 100 billion euro as of end-2006.

In Table 1 we highlight a subsample of major banks from the United States, United Kingdom, Australia, and Switzerland. United States is the most important trade and financial partner of Canada and has been at the center of the turmoil. United Kingdom and Switzerland are major

international financial centers affected by the turmoil. The structures of the Australian economy and banking sector are similar to those of Canada: both are industrialized country with a large extracting industry and a relatively small number of large banks. We track the performance of these banks closely in further analysis.

## B. Capitalization

We first consider bank capital ratios prior to the crisis. We measure capitalization as a ratio of total equity over total assets. This leverage-based measure has a number of shortcomings stemming from its simplicity: it is not risk-weighted and does not consider off-balance sheet exposures. However, it is well comparable across countries.

We find that this simple measure of capitalization turns out to be a good predictor of bank performance during the turmoil, particularly by identifying vulnerabilities stemming from critically low bank capital (Table 2). Of the twelve banks with the lowest capital ratio at the end of 2006, six have lost more than 85 percent of equity value and four others between 70 and 85 percent of equity value. Similarly, for the same twelve banks, five required a significant government intervention due to extreme stress, and five more

Table 2. Capital Ratios

| Bank  | Country        | Capital*   | Value decline | Intervention                          |
|---|----------------|------------|---------------|---------------------------------------|
| <b>Twelve most vulnerable</b>                 |                |            |               |                                       |
| 1 Hypo Real Estate Holding AG                 | GERMANY        | 2.1        | 97            | Asset guarantees and public loans     |
| 2 Deutsche Bank AG                            | GERMANY        | 2.1        | 81            |                                       |
| 3 UBS AG                                      | SWITZERLAND    | 2.3        | 79            | Capital injection                     |
| 4 Commerzbank AG                              | GERMANY        | 2.5        | 89            | Capital injection                     |
| 5 ABN Amro Holding NV                         | NETHERLANDS    | 2.6        | NA            | Nationalized (carved out from Fortis) |
| 6 Barclays Plc                                | UNITED KINGDOM | 2.7        | 85            |                                       |
| 7 Fortis                                      | BELGIUM        | 2.8        | 94            | Broken up, part nationalized          |
| 8 Dresdner Bank AG                            | GERMANY        | 3.0        | NA            | Capital injection                     |
| 9 Northern Rock Plc                           | UNITED KINGDOM | 3.2        | 100           | Nationalized                          |
| 10 Dexia                                      | BELGIUM        | 3.3        | 89            | Nationalized                          |
| 11 ING Groep NV                               | NETHERLANDS    | 3.3        | 81            | Recapitalized, asset guarantees       |
| 12 Lloyds TSB Group Plc                       | UNITED KINGDOM | 3.3        | 78            | Capital injection                     |
| <b>Rest of the sample</b>                     |                |            |               |                                       |
| 16 HBOS Plc                                   | UNITED KINGDOM | 3.6        | 100           | Recapitalized (part of Lloyds)        |
| <b>20 Canadian Imperial Bank of Commerce</b>  | <b>CANADA</b>  | <b>4.1</b> | 54            |                                       |
| <b>21 Royal Bank of Canada RBC</b>            | <b>CANADA</b>  | <b>4.3</b> | 44            |                                       |
| 26 Credit Suisse Group                        | SWITZERLAND    | 4.7        | 66            |                                       |
| <b>28 Banque de Montreal-Bank of Montreal</b> | <b>CANADA</b>  | <b>4.8</b> | 53            |                                       |
| <b>29 Bank of Nova Scotia (The) -</b>         | <b>CANADA</b>  | <b>4.9</b> | 42            |                                       |
| 35 Royal Bank of Scotland Group Plc (The)     | UNITED KINGDOM | 5.2        | 96            | Capital injection, asset guarantees   |
| 36 Westpac Banking Corporation                | AUSTRALIA      | 5.3        | 38            |                                       |
| 40 Commonwealth Bank of Australia             | AUSTRALIA      | 5.7        | 46            |                                       |
| 41 National Australia Bank                    | AUSTRALIA      | 5.7        | 53            |                                       |
| <b>42 Toronto Dominion Bank</b>               | <b>CANADA</b>  | <b>5.7</b> | 43            |                                       |
| 44 Australia and New Zealand Banking Group    | AUSTRALIA      | 5.9        | 54            |                                       |
| 50 Citigroup Inc                              | USA            | 6.4        | 94            | Recapitalized, asset guarantees       |
| 55 HSBC Holdings Plc                          | UNITED KINGDOM | 6.6        | 41            |                                       |
| 61 Washington Mutual Inc.                     | USA            | 8.5        | 100           | Failed, taken over by FDIC            |
| 62 JP Morgan Chase & Co.                      | USA            | 8.6        | 50            |                                       |
| 63 Bank of America Corporation                | USA            | 9.3        | 87            | Capital injection, asset guarantees   |
| 64 Wells Fargo & Company                      | USA            | 9.5        | 47            |                                       |
| 68 Wachovia Corporation                       | USA            | 10.3       | 100           | Failed, acquired by Wells Fargo       |
| 72 Capital One Financial Corporation          | USA            | 16.9       | 80            |                                       |

\* Equity over total assets, end-2006  
Source: BankScope and staff calculations

|      |                       |
|------|-----------------------|
| >85% | Due to extreme stress |
| >70% | Due to other weakness |

due to other weakness. All of the twelve banks were affected by the turmoil either by stock return or by government intervention measures.

Capital ratios of Canadian banks were generally in the third (from the highest) quartile of the sample: below average, not particularly strong, but high enough to avoid insolvency problems on minor losses.

Interestingly, a high level of capital by itself did not make banks immune during the turmoil. A number of large banks appeared highly capitalized before the crisis, but quickly exhausted capital buffers as a result of significant exposure to troubled assets or questionable acquisitions.



### C. Liquidity

We now turn to bank liquidity. We measure balance sheet liquidity as the ratio of liquid assets over total debt liabilities. We use the BankScope measure of liquid assets, which includes cash, government bonds, short-term claims on other banks (including certificates of deposit), and where appropriate the trading portfolio. BankScope harmonizes data from different jurisdictions to arrive at a globally comparable indicator. Data for bank liquidity is shown in Table 3.

Note that a large number of U.S. banks have very scarce balance sheet liquidity. The key reason is that those banks, in their risk-management, treated mortgage-backed securities and municipal bond as liquid, and reduced holdings of other more reliably liquid assets such as government securities. Our liquidity measure does not incorporate holdings of such private and quasi-private securities. With hindsight, it is fair to say that this narrow definition is a more accurate measure of liquidity during crisis.

It is also interesting to observe that the amount of balance sheet liquidity seems to depend on the bank's business model. For example, banks active in asset and wealth management (notably the two Swiss banks) are on average more liquid as they hold larger marketable portfolios for capital market operations.

Canadian banks had good balance sheet liquidity at the onset of the turmoil: above average, being in the second quartile (from the highest) of the OECD sample. This has likely contributed to their resilience.

Australian banks were notable in their consistently low liquidity levels; all are in the bottom quartile of the OECD sample. Indeed, low balance sheet liquidity was identified as a major source of vulnerability by the Financial System Stability Assessment of Australia (IMF, 2006).

Yet overall, balance sheet liquidity was a weaker predictor of resilience to the turmoil than the capital ratio. Although low liquidity was a clear handicap (of twelve least liquid banks, eight had equity price declines of more than 70 percent, and four required a significant government intervention), a large number of banks from different countries (U.S., UK, Switzerland) experienced significant distress despite being relatively liquid. Another way to think about the resilience effects of balance sheet liquidity is to recognize that it can provide only temporary relief from funding pressures. During a protracted turmoil, more fundamental determinants of resilience—such as capital or funding structure—should play a bigger role.

**Table 3. Balance Sheet Liquidity**

| Bank  | Country        | Liquidity*   | Value decline | Intervention                             |
|---|----------------|--------------|---------------|--|
| <i>Twelve most vulnerable</i>                 |                |              |               |  |
| 1 Capital One Financial Corporation           | USA            | 3.7          | 80            |  |
| 2 National City Corporation                   | USA            | 4.0          | 100           | Acquired by PNC Bank                     |
| 3 Citizens Financial Group Inc.               | USA            | 4.3          | NA            | NA (owned by RBS)                        |
| 4 SunTrust Banks, Inc.                        | USA            | 4.3          | 85            |  |
| 5 US Bancorp                                  | USA            | 4.4          | 58            |  |
| 6 Washington Mutual Inc.                      | USA            | 4.8          | 100           | Failed, taken over by FDIC               |
| 7 Regions Financial Corporation               | USA            | 5.0          | 90            |  |
| 8 Nomura Holdings Inc                         | JAPAN          | 5.6          | 76            |  |
| 9 Wells Fargo & Company                       | USA            | 6.0          | 47            |  |
| 10 Northern Rock Plc                          | UNITED KINGDOM | 6.7          | 100           | Nationalized                             |
| 11 Kookmin Bank                               | KOREA REP. OF  | 7.8          | 56            |  |
| 12 Bank of Ireland                            | IRELAND        | 8.4          | 96            | Capital injection, liabilities guarantee |
| <i>Rest of the sample</i>                     |                |              |               |  |
| 13 Commonwealth Bank of Australia             | AUSTRALIA      | 8.90         | 46            |  |
| 14 Australia and New Zealand Banking Group    | AUSTRALIA      | 10.32        | 54            |  |
| 16 Westpac Banking Corporation                | AUSTRALIA      | 10.42        | 38            |  |
| 17 Wachovia Corporation                       | USA            | 10.69        | 100           | Failed, acquired by Wells Fargo          |
| 18 HBOS Plc                                   | UNITED KINGDOM | 11.14        | 100           | Capital injection (part of Lloyds)       |
| 19 National Australia Bank                    | AUSTRALIA      | 11.15        | 53            |  |
| 26 Lloyds TSB Group Plc                       | UNITED KINGDOM | 15.67        | 78            | Capital injection                        |
| <b>41 Banque de Montreal-Bank of Montreal</b> | <b>CANADA</b>  | <b>23.99</b> | 53            |  |
| <b>44 Toronto Dominion Bank</b>               | <b>CANADA</b>  | <b>24.37</b> | 43            |  |
| <b>45 Bank of Nova Scotia (The) -</b>         | <b>CANADA</b>  | <b>24.43</b> | 42            |  |
| 47 Royal Bank of Scotland Group Plc (The)     | UNITED KINGDOM | 25.11        | 96            | Capital injection, asset guarantees      |
| 49 Bank of America Corporation                | USA            | 25.59        | 87            | Capital injection, asset guarantees      |
| <b>50 Canadian Imperial Bank of Commerce</b>  | <b>CANADA</b>  | <b>26.00</b> | 54            |  |
| <b>56 Royal Bank of Canada RBC</b>            | <b>CANADA</b>  | <b>32.11</b> | 44            |  |
| 59 HSBC Holdings Plc                          | UNITED KINGDOM | 33.20        | 41            |  |
| 63 Citigroup Inc                              | USA            | 39.46        | 94            | Recapitalized, asset guarantees          |
| 64 Barclays Plc                               | UNITED KINGDOM | 40.75        | 85            |  |
| 69 JP Morgan Chase & Co.                      | USA            | 46.80        | 50            |  |
| 71 Credit Suisse Group                        | SWITZERLAND    | 64.93        | 66            |  |
| 72 UBS AG                                     | SWITZERLAND    | 65.20        | 79            | Capital injection                        |

\* Liquid assets over total liabilities, end-2006  
Source: BankScope and staff calculations

|      |                       |
|------|-----------------------|
| >85% | Due to extreme stress |
| >70% | Due to other weakness |

#### D. Funding Structure

We now turn to bank funding structure (depository vs. wholesale market funding). The financial turmoil has originally propagated through wholesale financial markets, some of which effectively froze on occasions. Our measure of funding structure, a ratio of depository funding over total assets, seeks to reflect banks' exposure to rollover risks — the wholesale market's refusal to roll over short-term funding, often based only on very mild negative information or rumors (Huang and Ratnovski, 2008).

For example, Yorulmazer (2008) finds that British banks that relied more on funding from wholesale markets were more affected in the wake of Northern Rock's collapse. Poghosyan and Cihak (2009) examine bank distress in European Union countries from mid-1990s to 2008 and find that wholesale financing can distinguish sound banks from vulnerable banks.

Ideally, we would also like to distinguish transaction accounts, insured retail deposits, from large denomination deposits, which effectively behave like wholesale market funds. Yet the only consistently available measure of funding structure, in Bankscope database or banks annual reports, that is comparable across countries is simply the total amount of depository funding. The measure is admittedly imperfect but remains the best available.

We find that even when measured in this imperfect way, the funding structure is an important predictor of bank resilience during the turmoil (Table 4). Of the twelve most vulnerable large OECD banks, six have experienced equity declines of over 85 percent, and four more experienced equity declines of between 70 and 85 percent. Five of the same twelve banks required government intervention due to extreme stress, and one more due to other weakness.

Yet, similar to capital and liquidity, even a relatively high share of depository funding could not save banks exposed to significant losses on bad assets from severe distress (notably Washington Mutual, Wachovia, UBS, Lloyds TSB, Royal Bank of Scotland).<sup>3</sup>

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<sup>3</sup> Another possible reason is that substantial fraction of deposits in these banks came from market sources, such as large denomination CDs and brokered deposits. One striking example is that of Washington Mutual which, according to the Office of Thrift Supervision, suffered a massive withdrawal of \$16.5 billion by large depositors in two weeks preceding its collapse.

**Table 4. Depository Funding**

| Bank  | Country        | Depository funding* | Value decline | Intervention                        |
|---|----------------|---------------------|---------------|-------------------------------------|
| <i>Twelve most vulnerable</i>                 |                |                     |               |                                     |
| 1 Hypo Real Estate Holding AG                 | GERMANY        | 24.0                | 97            | Asset guarantees and public loans   |
| 2 Northern Rock Plc                           | UNITED KINGDOM | 28.7                | 100           | Nationalized                        |
| 3 Deutsche Bank AG                            | GERMANY        | 34.1                | 81            |                                     |
| 4 BNP Paribas                                 | FRANCE         | 36.7                | 65            |                                     |
| 5 Citigroup Inc                               | USA            | 37.8                | 94            | Capital injection, asset guarantees |
| 6 HBOS Plc                                    | UNITED KINGDOM | 41.0                | 100           | Capital injection (part of Lloyds)  |
| 7 Société Générale                            | FRANCE         | 42.0                | 74            |                                     |
| 8 Banca Monte dei Paschi di Siena SpA         | ITALY          | 44.1                | 68            |                                     |
| 9 Dexia                                       | BELGIUM        | 44.9                | 89            | Nationalized                        |
| 10 DnB Nor ASA                                | NORWAY         | 45.4                | 74            |                                     |
| 11 Danske Bank A/S                            | DENMARK        | 46.3                | 78            |                                     |
| 12 Commerzbank AG                             | GERMANY        | 47.0                | 89            | Capital injection                   |
| <i>Rest of the sample</i>                     |                |                     |               |                                     |
| 13 JP Morgan Chase & Co.                      | USA            | 47.3                | 50            |                                     |
| 14 Barclays Plc                               | UNITED KINGDOM | 47.7                | 85            |                                     |
| 15 Bank of America Corporation                | USA            | 47.9                | 87            | Capital injection, asset guarantees |
| 21 National Australia Bank                    | AUSTRALIA      | 51.7                | 53            |                                     |
| 24 Commonwealth Bank of Australia             | AUSTRALIA      | 53.4                | 46            |                                     |
| 26 HSBC Holdings Plc                          | UNITED KINGDOM | 54.9                | 41            |                                     |
| 28 Credit Suisse Group                        | SWITZERLAND    | 55.6                | 66            |                                     |
| 30 Capital One Financial Corporation          | USA            | 57.3                | 80            |                                     |
| 32 Lloyds TSB Group Plc                       | UNITED KINGDOM | 58.7                | 78            | Capital injection                   |
| 33 Royal Bank of Scotland Group Plc (The)     | UNITED KINGDOM | 59.3                | 96            | Capital injection, asset guarantees |
| 44 Wachovia Corporation                       | USA            | 62.8                | 100           | Failed, acquired by Wells Fargo     |
| 46 UBS AG                                     | SWITZERLAND    | 64.1                | 79            | Capital injection                   |
| 48 Wells Fargo & Company                      | USA            | 64.4                | 47            |                                     |
| <b>51 Royal Bank of Canada RBC</b>            | <b>CANADA</b>  | <b>65.1</b>         | 44            |                                     |
| <b>52 Banque de Montreal-Bank of Montreal</b> | <b>CANADA</b>  | <b>65.2</b>         | 53            |                                     |
| 54 Australia and New Zealand Banking Group    | AUSTRALIA      | 65.4                | 54            |                                     |
| <b>57 Toronto Dominion Bank</b>               | <b>CANADA</b>  | <b>67.9</b>         | 43            |                                     |
| <b>60 Canadian Imperial Bank of Commerce</b>  | <b>CANADA</b>  | <b>68.2</b>         | 54            |                                     |
| <b>64 Bank of Nova Scotia (The) -</b>         | <b>CANADA</b>  | <b>71.4</b>         | 42            |                                     |
| 68 Westpac Banking Corporation                | AUSTRALIA      | 74.1                | 38            |                                     |
| 69 Washington Mutual Inc.                     | USA            | 74.6                | 100           | Failed, taken over by FDIC          |

\* Depository funding over total assets  
Source: BankScope and staff calculations

|      |                       |
|------|-----------------------|
| >85% | Due to extreme stress |
| >70% | Due to other weakness |

Canadian banks are clearly the “positive outliers” among OECD banks in the ratio of depository funding to total assets. On this ratio, almost all large Canadian banks are in the top quartile of our sample. Anecdotal evidence also suggests that a higher fraction (than in the U.S.) of Canadian bank deposits are “core deposits,” i.e., transaction accounts and small deposits, which are “stickier” than large deposits.

One likely reason for Canadian banks’ firm grip of deposit supply is their ability to provide one-stop service in mutual funds and asset management. Unlike in the U.S. Canadian banks have been historically universal banks, and there is relatively less competition for household savings from other alternative investment vehicles.

This also contrasts, for example, with the experience of Australia. The Financial System Stability Assessment for Australia (IMF, 2006) suggests that the key institutional reason behind Australian banks reliance of wholesale funding is strong competition for household savings from superannuation funds (private pension schemes). Note that although the deposit-to-assets ratio shown in Table 4 is quite high for some Australian banks, a substantial share of those deposits comes from overseas sources and money markets.

### **E. Multivariate Regression Analysis**

In this section, we support our casual observations with formal multivariate regression analysis. Specifically, we analyze the same sample of large commercial banks in OECD countries, and look for the best predictors of bank performance during the turmoil.

To increase robustness and reduce arbitrariness, we use four alternative outcome variables to measure bank performance. See Section II.A for discussions of the variables.

- (1) A dummy variable for government intervention in response to extreme stress;
- (2) A dummy variable for an equity price decline of more than 85 percent;
- (3) A dummy variable for an equity price decline of more than 70 percent;
- (4) The absolute percentage decline of the equity price.

Equity price declines are measured between January 2007 and January 2009. Measures based on equity prices are not available for ten banks that are not publicly-traded.

The main explanatory variables include the equity to asset ratio, balance sheet liquidity to total debt liabilities ratio, the depository funding to total asset ratio, and the log of total assets.

In alternative specifications, we also address additional non-linear effects by:

- (1) including dummy variables for critically low levels of capital (below 4 percent) and depository funding (below 50 percent), because the detrimental effects may be evident only when the two ratios are critically low;
- (2) including an interaction term between capital and depository funding, because the two may be substitutes for each other during the credit turmoil.

Regression results are shown in Table 5.

The main specification (columns 1, 4, 7, 10) shows that depository funding significantly and robustly explains bank performance during the credit turmoil, consistent with initial casual observations of the data. Balance sheet illiquidity is a good predictor of particularly rapid deteriorations in bank conditions (government intervention under

extreme stress or equity decline above 85 percent). However, interestingly, the capital ratio appears as an insignificant explanatory variable.

To better understand the nonlinear effect and interaction between the explanatory variables, we perform a number of additional checks on alternative specifications.

First, we include as explanatory variables dummy variables for critically low capital and depository funding (columns 2, 5, 8, 11). We find that, consistent with initial observations from data, critically low capital is indeed a significant predictor of future bank performance (in terms of equity price decline). However, it is not a significant predictor of extreme stress.

Second, we consider the interaction between capital and depository funding (columns 3, 6, 9, 12). Interestingly, the interaction between capital and deposits enters regressions with a significant positive sign – suggesting substitutability between the two: a bank with higher capital needs fewer deposits, and a bank with more deposits can sustain lower capital, for the same degree of resilience.

The regressions also control for bank size. Bank size is a significant predictor of government involvement, consistent with the conjecture that the government is more likely to intervene in larger banks. Finally, we also find (but do not report here) that asset growth over the past three years preceding the crisis was not related to bank performance during the credit turmoil.

The regression results are complementary to the analysis of the IMF *Global Financial Stability Report* (2009B, April, Chapter 3). This paper and the GFSR use a different sample of banks, and different dependent and explanatory variables, but nevertheless obtain broadly consistent results. This provides evidence to the robustness of the common approach. Compared to the GFSR, our results highlight novel effects associated with critical undercapitalization of banks, balance sheet liquidity, and depository funding.

**Table 5: The determinants of bank performance during the financial turmoil**

| Dependent Variable:               | Extreme Stress        |                       |                       | Price Decline >85%   |                      |                      | Price decline>70%   |                     |                      | Price decline (%)    |                     |                      |
|-----------------------------------|-----------------------|-----------------------|-----------------------|----------------------|----------------------|----------------------|---------------------|---------------------|----------------------|----------------------|---------------------|----------------------|
|                                   | (1)                   | (2)                   | (3)                   | (4)                  | (5)                  | (6)                  | (7)                 | (8)                 | (9)                  | (10)                 | (11)                | (12)                 |
| Equity Ratio                      | -0.182<br>(0.454)     | 0.259<br>(0.187)      | -3.042***<br>(3.419)  | 1.240<br>(2.025)     | 3.580**<br>(1.221)   | -31.80***<br>(10.02) | -0.907<br>(3.692)   | 3.685<br>(3.053)    | -51.03***<br>(18.96) | 11.88<br>(122.8)     | 190.6**<br>(85.48)  | -1448***<br>(366.1)  |
| Equity Ratio<4%                   |                       | 0.0802<br>(0.0988)    |                       |                      | 0.361**<br>(0.183)   |                      |                     | 0.558***<br>(0.125) |                      |                      | 22.20***<br>(4.511) |                      |
| Balance Sheet Liquidity           | -0.541***<br>(0.431)  | -0.425***<br>(0.377)  | -0.382***<br>(0.336)  | -1.527***<br>(0.576) | -1.694***<br>(0.631) | -1.187**<br>(0.538)  | -0.890<br>(0.611)   | -1.151<br>(0.835)   | -0.402<br>(0.601)    | -33.20<br>(24.64)    | -25.77<br>(21.94)   | -17.73<br>(22.43)    |
| Depository Funding                | -0.326***<br>(0.224)  | -0.281**<br>(0.204)   | -0.479***<br>(0.447)  | -1.133**<br>(0.401)  | 0.536<br>(0.629)     | -3.836***<br>(1.029) | -1.156**<br>(0.492) | 1.776***<br>(0.600) | -5.543***<br>(2.152) | -51.68***<br>(17.59) | 17.66<br>(17.91)    | -167.9***<br>(36.38) |
| Depository Funding<50%            |                       | -0.0148<br>(0.0224)   |                       |                      | 0.473**<br>(0.228)   |                      |                     | 0.576***<br>(0.116) |                      |                      | 13.07**<br>(4.775)  |                      |
| Equity Ratio * Depository Funding |                       |                       | 5.208***<br>(5.480)   |                      |                      | 58.15***<br>(17.33)  |                     |                     | 87.43***<br>(33.46)  |                      |                     | 2545***<br>(597.0)   |
| Log (Asset)                       | 0.0629***<br>(0.0574) | 0.0517***<br>(0.0526) | 0.0529***<br>(0.0516) | 0.142<br>(0.0938)    | 0.142<br>(0.106)     | 0.168<br>(0.105)     | 0.123<br>(0.0916)   | 0.0937<br>(0.124)   | 0.135<br>(0.0953)    | 4.025<br>(2.664)     | 2.353<br>(2.707)    | 4.988*<br>(2.785)    |
| N                                 | 72                    | 72                    | 72                    | 62                   | 62                   | 62                   | 62                  | 62                  | 62                   | 62                   | 62                  | 62                   |
| R-squared                         | 0.393                 | 0.435                 | 0.450                 | 0.139                | 0.240                | 0.233                | 0.084               | 0.282               | 0.170                | 0.147                | 0.323               | 0.269                |

**Note:** The regressions are based on a sample of large OECD banks (assets above 100 billion euro at end-2006). The dependent variables include three dummy variables for government intervention in response to extreme stress, bank stock price decline by >85%, and bank stock price decline by >70%, as well as the absolute value of stock price decline. Stock price declines are measured between January 2007 and January 2009. Equity ratio is the equity-to-asset ratio; balance sheet liquidity is the liquid assets-to-debt-liabilities ratio; depository funding is the deposit-to-asset ratio; all taken at end of fiscal year 2006. The regressions involving dummy variables are estimated based on Probit, with coefficients transformed to be interpreted as probability change (0 to 1). Otherwise the regressions are estimated with OLS. T-statistics adjusted for clustering of residuals by countries are reported in parenthesis. Symbols \*\*\*, \*\*, \* indicate statistical significance at the 1%, 5%, and 10% level, respectively.

## F. Asset-Side Exposures

Our regression analyses examine banks' balance sheet *structures* but not banks' asset-side risk exposures. Arguably, two types of exposures have been key sources of bank losses during the crisis: exposures to troubled U.S. assets, and exposures to inflated domestic housing markets and over-leveraged consumers.

We examine balance sheet structures because we consider asset investment decisions as endogenous to the choice of funding structures. Huang and Ratnovski (2008) provide a theoretic explanation why banks tend to match wholesale funding with arms' length assets such as mortgage-backed securities and their derivative structured products.

Canadian banks were indeed distinguished by limited exposure to troubled U.S. assets. There are a number of possible explanations for this beneficial outcome: sound risk-management, regulation that discourages non-core foreign activities (see next section), and potentially low gains from diversification into a closely correlated economy. There is no doubt that limited exposure to troubled U.S. assets has contributed to the stability of Canadian banks during the turmoil. Also, Canadian house prices appear not to be over-inflated (except locally for some provinces, see Tsounta, 2009).

The fact that our analysis could predict the most vulnerable banks without using any information on asset side exposures is by itself an important result. It highlights the importance of asset and liability *structure*. It points to strategic decisions in business model choice instead of tactical investment mistakes as the more likely cause of some banks dismal performance during the crisis.

Further, from a practical perspective, it may be easier for regulatory agencies to monitor observable structural indicators, which are more difficult to manipulate, than to verify complex risk exposures on the asset side.

Sound fundamentals may soften the impact of risky exposures when they are present. For example, a relatively strong depository funding ratio in Canadian Imperial Bank of Commerce has probably contributed to its stability in the face of a material exposure to troubled assets, and allowed it to raise capital in an orderly manner. Weak structural fundamentals may pose risks even when risky exposures are limited. For example, Northern Rock did not have any material exposures to the U.S. subprime sector.



### III. REGULATORY AND STRUCTURAL ENVIRONMENT IN CANADA

Sound fundamentals of Canadian banks were complemented, and in part caused, by regulatory and industry structure that discouraged banks from taking excessive risks. This section describes some features of that environment.

#### A. Capital Regulation

Bank capital regulation in Canada centers around two key thresholds: minimum risk-based capital ratios and a maximum assets-to-capital multiple (inverse leverage).

- **Risk-based capital.** The Basel Accord requires internationally active banks to hold tier 1 capital of at least 4 percent and total capital of at least 8 percent of risk-weighted assets. Canada imposes capital requirement target that are higher than the Basel minima: tier 1 capital of 7 percent and total capital of 10 percent.

The targets are explicit and identical for all banks, and are implemented as part of Basel II Pillar 2 requirements. The targets were put in place in 1997 (all large domestic banks were in compliance with regulation at the time of its introduction) and were retained after the implementation of Basel II in 2008.

In addition, Canadian capital regime requires that at least 75% of tier 1 capital is formed of common equity, and restricts innovative instruments to 15 percent of tier 1 capital. (The thresholds were recently temporarily relaxed to 40 percent to allow banks extra flexibility in the face of possible funding pressures, as a means of counter-cyclical capital policy.)

- **Assets-to-capital multiple.** In addition to risk-based capital, Canada uses an assets-to-capital multiple (inverse leverage ratio) calculated by dividing the institution's total assets by total (tiers 1 and 2) capital. The maximum multiple is set at 20 (leverage ratio of 5%). Exemptions for the multiple of up to 23 may be granted on an individual basis by the Office of the Superintendent of Financial Institutions (OSFI). The allowed multiple may also be reduced at the discretion of OSFI, for example for rapidly-growing institutions.

Besides providing an enhanced capital cushion, the stringent capital requirements have beneficial incentive effects on banks. Higher capital requirements restrict rapid balance sheet expansion that may lead to reckless investments. Similarly, banks constrained in balance sheet size engage less in wholesale operations, as retail operations can satisfy a

greater fraction of their investment needs. Finally, banks subject to more rigorous capital requirements than elsewhere are less competitive internationally; they have lower incentives for foreign expansion except in cases where they can have a distinct competitive advantage.

### **B. Liquidity Framework in Canada**

Liquidity guidelines in Canada specify that banks have to maintain a stock of highly liquid assets appropriate for their cash flow and funding profile. Banks with more than 10 percent of funding coming from wholesale sources are required to put in place internal limits on short-term (e.g., next day, 2-7 days and 8-30 days) funding requirements and actively measure and monitor actual requirements against those limits. The current guidelines have no quantitative liquidity minimum, emphasizing stress-testing and contingency planning instead.

### **C. Banking Market Structure**

A number of broader structural factors have likely contributed to the Canadian banks' stable retail deposit base and lower risk-taking.

The Canadian banking sector is dominated by six large banks with an integrated nationwide branch network. The national franchise is highly profitable and valuable, and banks are keen to preserve it, thereby avoiding excess risks that could compromise the franchise. Customers value the capabilities of a nation-wide bank branch network, and the demand for it serves as a barrier to the contestability of Canadian banking services especially in deposit and debt card products. Limited external competition reduces pressures to defend or expand market share, again reducing incentives to take risks.

Retail funding supply and retail loan demand appear well-matched in Canada, reducing banks' need to engage in wholesale borrowing or lending activities. Larger corporations typically borrow directly from capital markets, or from syndicates that include and are often led by foreign banks, possibly because a higher capital requirement increases local banks' cost of capital and reduces their competitiveness in the syndicated loans market.

Finally, the Canadian mortgage market is relatively conservative, with a number of factors contributing to the prudence of mortgage lending (see Kiff, 2009). Less than 3 percent of mortgages are subprime and less than 30 percent of mortgages are securitized (compared with about 15 percent and 60 percent respectively in the United States prior to the crisis). Mortgages with a loan-to-value ratio of more than 80 percent need to be insured for the whole amount (rather than the portion above 80 percent as in the United

States). Mortgages with a loan-to-value ratio of more than 95 percent cannot be underwritten by federally-regulated depository institutions. To qualify for mortgage insurance, mortgage debt service-to-income ratio should usually not exceed 32 percent and total debt service 40 percent of gross household income. Few fixed-rate mortgages have a contract term longer than five years.

#### **IV. CONCLUSIONS**

The paper analyzed pre-crisis balance sheet structural fundamentals of Canadian banks and compared them with banks in other OECD countries. We found that ample retail depository funding was the key factor behind the relative resilience of Canadian banks during the turmoil. Sufficient capital and liquidity were also important but played a less distinctive role. In addition, a number of regulatory and structural factors have reduced Canadian banks' incentives to take risks. Results allow a conjecture that strong structural fundamentals of Canadian banks will remain a source of their resilience as the financial turmoil and economic recession persist.

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