

Balance Sheet Structure, Bank Mergers, and Bank
Failures in Canada, 1892-1941

by

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Abstract

The Canadian banking system underwent extensive structural change between 1900 and 1930 as assets became concentrated among a handful of large chartered banks. The period provides an opportunity to identify differences in balance sheet composition and their contribution to the probability of bank acquisition or failure during the emergence of systemic stability. Using balance sheet data for individual banks I show that a high ratio of non-performing loans to total assets dramatically increased the likelihood of bank failure. Banks with a low ratio of capital to assets, which lacked protection against insolvency, were more likely to be acquired or fail. However, the actions of predator banks did not depend on the capital-to-asset ratios of target banks.

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1 Introduction

The current financial crisis has revived interest in the industrial organization of banking systems and the regulation of banks' balance sheets.¹ Why do some banks fail while others are absorbed by predator banks in mergers and acquisitions? A recent literature has considered the role of fundamental bank characteristics (Calomiris and Mason 2003), branch banking networks (Mitchener and Carlson 2009), and managerial performance (Wheelock and Wilson 2000). Canadian banks have been cited as a "pillar of stability" during the present day crisis, amidst the debris of bailouts, subprime mortgages and home foreclosures.² Tighter regulation, more liquidity and less highly leveraged banks have contributed to the ranking of Canada's banks as the world's soundest by the World Economic Forum.³ While contemporary debates have focused attention on the appropriate structure of bank balance sheets in the aftermath of the financial crisis, the historical experience of Canadian banks provides a case study of balance sheet composition in a stable banking system. In this paper, I focus on Canadian chartered banks between 1892 and 1941 as I examine whether the structure of balance sheets differed significantly between predator banks, banks absorbed in mergers and banks that failed. Then I analyze how the behavior of banks and the evolving concentration of the banking system influenced the likelihood of bank failures and acquisitions.

The Canadian banking system experienced remarkable stability during the

¹"Rebuilding the banks," *The Economist*, 16 May 2009.

²Paul Krugman, "Gordon the Unlucky," *New York Times*, 7 June 2009.

³Keith B. Richburg, "Worldwide Financial Crisis Largely Bypasses Canada," *Washington Post*, 16 October 2008, A11.

20th century with the demise of the Home Bank in 1923 representing the only bank failure between World War One and the 1980s. The absence of failures in a highly concentrated banking industry dominated by an oligopoly of five banks with extensive nationwide branch-banking networks, especially during the Great Depression, demands explanation. In contrast, the banking system experienced intermittent failures while depositors and note-holders were burdened with losses during the decades prior to the period of relative stability. The Canadian banking system underwent significant structural change between 1900 and 1925 as a wave of mergers and acquisitions consolidated the number of chartered banks from 41 to 10, the approximate number of banks that would operate for the next half-century. The contribution of banks' balance sheet structure to the likelihood of acquisition or failure has not been examined thoroughly by the previous literature on Canadian banks. The merger movement in the Canadian banking industry coincided with a period of sustained economic growth characterized by increased industrialization, urbanization and an investment boom fueled by foreign capital. Thus, the issues examined in this paper also reinforce the important role of financial institutions and intermediation in the process of economic growth.⁴ The identification of the characteristics which distinguished failed banks from those that merged contributes to our understanding of the factors associated with structural changes in banking systems. The determination that predator banks neither targeted nor avoided insolvent banks suggests that the merger movement contributed to the improved stability of the banking system through the elimination of weaker institutions.

⁴See Levine (2004) for a review of this voluminous literature.

I use a new historical data set consisting of the components of the balance sheets for all Canadian chartered banks between 1892 and 1941. I compiled the annual data from the supplement “The Return of the Chartered Banks of the Dominion of Canada,” published monthly in the *Canada Gazette* as required by the Minister of Finance. While the aggregate figures from this source have been published extensively and elements of the data have been examined elsewhere, the evolution of balance sheets over time for individual banks have not been analyzed previously. In combination with data on other bank characteristics and information on the date of bank failures and mergers, I examine how the balance sheet components affected the timing of banking sector consolidation. The results show that small banks and banks with less equity in their portfolios were more likely to fail or be absorbed in a merger. This is consistent with the finding that the structure of the balance sheets for failing and target banks were characterized by significantly higher leverage and less liquidity, leaving them at risk of insolvency.⁵ However, the evidence does not suggest that predator banks preferred to take over poorly performing institutions. I argue that banks had the incentive to acquire the best targets, in order to improve profitability, and to acquire the worst targets, which came with a low price. A high share of illiquid real estate holdings and poor quality non-performing loans clearly distinguished failing banks from those acquired in mergers.

The paper is structured as follows. Section 2 reviews the related literature. In Section 3, I describe the construction of the data set and present the summary

⁵Throughout the paper liquidity refers to the sufficiency of a bank’s liquid asset holdings for meeting its obligations to depositors. When a bank has negative net worth – the value of its liabilities exceed its assets – its assets are not sufficient to pay off its depositors and the bank becomes insolvent (Mishkin and Serletis 2004, p. 202).

statistics for the components of banks' balance sheets. Section 4 provides historical background. Section 5 analyzes the determinants of balance sheet structure for different categories of banks using the seemingly unrelated regression technique. Section 6 presents the estimation of the likelihood and timing of bank failures and mergers using logit regression models and survival duration analysis. Sections 5.2 and 6.2 discuss the results and compare them to previous findings. Section 7 concludes.

2 Literature Review

This paper contributes new empirical evidence to assess the findings of the literature that has examined the determinants of bank mergers and failures in Canada. One school of thought has argued that the diversification of assets across nationwide branching networks allowed Canadian banks to remain solvent and therefore accounts for the absence of bank failures in the 1930s (Ely 1988, O'Driscoll Jr. 1988). Others have debated whether the Canadian government actively promoted mergers to prevent the failure of troubled banks. Bordo (1986) claims that the Canadian Bankers' Association (CBA) arranged mergers between strong and weaker banks during the panics of 1893 and 1907. Similarly, based on archival evidence, Kryzanowski and Roberts (1993, p. 362) suggest that Canadian banks were insolvent during the 1930s and only survived because the government provided "an implicit one hundred percent guarantee of bank deposits." Beckhart (1929) also claimed that weaker banks were nearly insolvent, but placed the initiative for mergers with smaller banks which realized they could not compete with the larger institutions.⁶ Carr, Mathewson and

⁶Similarly, Jamieson (1953, p. 41) contends that small banks preferred to negotiate mergers with large banks instead of incurring the risk of expanding their own organization.

Quigley (1995) reject the claims that the CBA and Canadian government encouraged the merger of insolvent banks and that Canada had implicit deposit insurance given that many depositors suffered significant losses. They argue that market forces drove the merger movement since the assets of small banks were more valuable to larger institutions with stronger management and organizational form due to economies of scale. In the absence of empirical evidence, the literature has failed to distinguish whether failing banks were insolvent or illiquid, and thus the conclusions cannot be treated as definitive.

The bank characteristics that affect the probability of bank mergers have not been studied extensively in the previous literature. Hannan and Rhodes (1987) hypothesize that poorly managed firms are susceptible to acquisition by banks that seek gains by improving the performance of the target bank's assets to increase their profits. Bond and Shearer (1972) make reference to specific bank characteristics such as the threat of insolvency, limited diversification of asset holdings and high costs which may encourage banks to seek a merger. Wheelock and Wilson (2000) suggest that the objective of growth, achieved by accessing new markets and increasing market power, and by exploiting economies of scale, provides additional reasons for mergers. Strong institutions may also acquire insolvent banks to avoid the costs of contagion for the entire banking system that may arise from banking panics.⁷ The decisions by the large chartered banks to share the losses of the failing Ontario bank in 1906 and Sovereign bank in 1908 provide some indication that the Canadian banks were

⁷This point was suggested by Redish (2001) in an unpublished working paper.

concerned with the spillover effects of failure on the banking system at large.⁸

The new data analyzed in this study also represents an important contribution to the broader literature on the determinants of bank mergers. For the most part, empirical evidence has been limited to studies of banks in the United States (Hannan and Rhodes 1987, Amel and Rhodes 1989, Wheelock and Wilson 2000). One recent exception is the examination of contemporary Asian banks by Pasiouras and Gaganis (2007). Collins and Baker (2001) analyze the changes to the structure of bank balance sheets during the merger movement in England between 1860 and 1913 when large London-based banks absorbed many provincial banks. However, they do not explain the timing of mergers. Mitchener and Carlson (2009) examine data for California-based commercial banks during the wave of mergers and acquisitions in the 1920s and 1930s. They argue that branch banking improved the stability of the banking system by inducing changes in the competitive environment. They find no evidence that large branching networks targeted insolvent banks with low equity for acquisition, suggesting that the stability of the system did not improve through the elimination of weak banks. Instead, they show that the entry of large branching networks forced small banks to restructure their balance sheets in a manner consistent with increased profitability. Mitchener and Carlson's (2009) results for California banks during the merger movement from the 1920s through the Great Depression represent a natural comparison to Canadian chartered banks during the same period. However, the differences in the competitive environment for banking, such as the restrictions on branch banking in California, must be taken into account when making comparisons.

⁸Bond and Shearer (1972, p. 262).

On the other hand, the survival duration analysis that Mitchener and Carlson use to evaluate the factors affecting the timing of bank mergers can easily be applied to other contexts and terminal events. Therefore, I replicate their empirical methods closely to examine both bank mergers and failures of Canadian chartered banks.

A more extensive literature has studied bank failures, particularly in the context of the Great Depression in the United States.⁹ Calomiris and Mason (2003) analyze data for Federal Reserve member banks between 1929 and 1933 to evaluate the effect of bank characteristics as well as local, regional and national economic shocks on the timing of bank failures. Their results suggest that bank fundamentals had a larger role than contagion and liquidity crises in accounting for bank failures. Bond and Shearer (1972, p. 262) attribute the majority of bank failures in Canada to poor management or the fraudulent behavior of managers and directors who made extremely risky loans that became worthless. For example, criminal prosecutions revealed evidence of corruption and fraud by management in the failure of the Banque Ville Marie and Banque de St. Jean in 1899 and 1908, respectively, while speculation by the general manager in the stock exchange with the bank's funds contributed to the failure of the Ontario Bank in 1906.¹⁰ Neufeld (1972, p. 104) contends that the internal operations of banks, not external factors, accounted for failures, as banks often made exceedingly large individual loans relative to their total assets. Bordo, Rockoff and Redish (1996, p. 10) argue that the potential costs of mismanagement or fraud were exceedingly high for Canadian banks because they faced limited restric-

⁹See Calomiris (2007) for a review of the literature.

¹⁰Breckenridge (1910, 168–170).

tions on the types of assets they could invest in and they could expand rapidly by opening new branches or absorbing other banks.

The findings of a vast literature that has examined structural changes in banking systems in different historical contexts, some of which have been summarized here, represent points of comparison relevant to contemporary concerns about the appropriate structure of banks' balance sheets following the current financial crisis. The empirical methods employed by recent studies on the determinants of bank mergers and failures provide a means of assessing the claims made by the existing literature on Canadian banking based on anecdotal evidence. Using the historical Canadian data I evaluate the contribution of balance sheet characteristics to the likelihood of bank mergers and failures in a banking system with an oligopolistic structure. The results can be compared to those obtained by recent studies for different time periods in the United States.

3 Data

3.1 Data Sources and Construction

I compiled a comprehensive data set from the monthly *Canada Gazette* supplement containing series for the elements of Canadian chartered banks' balance sheets for all years between 1892 and 1941. I constructed annual series for components of total assets and liabilities with each bank-year observation representing the reported balance sheet values at the end of June. While consolidated bank statements of the chartered banks in Canada first appeared in August 1856, numerous banks did not report their returns and the statements were unreliable in the early years. According

to Curtis (1931), all chartered banks reported their returns beginning in July 1891 and thus I begin my series in 1892. Given that a consolidated record of undivided profits, income, and earnings of Canadian chartered banks prior to 1929 does not exist, the balance sheets represent the most comprehensive source of banking statistics for the years encompassing the merger movement. The primary strength of the data set is its completeness as it contains all 52 chartered banks that operated in Canada and includes all 29 bank mergers and 12 bank failures that occurred during the time period. Calomiris and Mason (2003, p. 1618) acknowledge the weakness of their data set which only includes national banks and state-chartered banks that were a part of the Federal Reserve System, whereas the majority of banks that failed during the Great Depression were non-member banks. In contrast, the data set for Canadian chartered banks will provide unbiased and representative estimates of factors contributing to bank failures and mergers. A limitation of the data set is that it does not include measures for rates of return or proxies for managerial performance.

The headings of the balance sheet columns changed frequently over time, making it impossible to construct measures of individual components that span the entire time period of the study. However, columns can be aggregated to create balance sheet categories consistent over time.¹¹ Among the assets, cash holdings consist of Dominion notes, or Bank of Canada notes after 1935, and foreign currency.¹² They also include the notes and cheques of other chartered banks that were cleared after a day's business. In the category of "near cash" or "secondary reserves" I include specie

¹¹Appendix A lists the balance sheet headings from different periods and shows the categories to which they have been assigned.

¹²The following descriptions of balance sheet categories draw on Curtis (1931).

as well as deposits with and balances due from other banks.¹³ A portion of reserves were regulated. The Bank Act revision of 1890 required each bank to contribute 5 percent of its average monthly note circulation into the Bank Circulation Redemption Fund held by the Minister of Finance. The fund earned 3 percent interest and provided security to redeem the notes of a failed bank.¹⁴ Banks also held a portion of their reserves as interest-earning call loans in New York, which could easily be converted to gold and returned to Canada.¹⁵

Securities and loans, either for the government or the private sector, represent the two broad classes of interest-earning assets. Additional illiquid asset categories included real estate, mortgages, and bank premises. The balance sheet category listed at various times as “overdue debts” or “non-performing loans” provides a proxy for loan quality. The 1913 Bank Act revision classified any loans as overdue debts if interest had not been paid for two years and the bank had taken possession of property as collateral.¹⁶ Liabilities consisted primarily of notes issued by the bank, deposits and capital. I compiled the sum of all deposits from different branches of government, other banks and the public. I also separately identified the deposits available on demand, typically less than 30 days notice. Bank capital consists of paid-up capital, the funds contributed by shareholders who purchase new equity or stocks, and the reserve fund, a surplus account from selling stocks at a premium. The

¹³Prior to 1913 some gold held by banks was included under the “other assets” heading. Not all specie was legal tender.

¹⁴McIvor (1958, p. 77).

¹⁵McIvor (1958, p. 81). Call loans are not classified as “near cash” since they cannot be identified separately prior to 1900. According to Curtis (1931), call loans in Canada were treated as loans with a longer notice period since they could not be obtained within a few hours.

¹⁶Beckhart (1929). The originally proposed definition covered any loans with no interest payments over a 12 month period, but this would have included over 50 percent of farm loans in the prairies.

measure of bank capital obtained from the *Canada Gazette* provides a proxy for a bank's net worth – the difference between its total assets and liabilities – since the returns did not report undivided profits or retained earnings.

In the estimation process I converted the balance sheet components into ratios expressed as a share of each bank's total assets, capital or deposits. This reflects the fact that the distribution of assets and liabilities across different components of the balance sheets is relevant to the decision process of banks, not the size of each component. The loan-to-asset ratio captures the riskiness of a bank's asset holdings. The capital-to-asset ratio indicates the extent of a bank's protection against insolvency risk.¹⁷ The cash-to-deposit ratio provides a measure of liquidity, while the deposits-to-capital ratio represents the extent of a bank's leverage. The ratio of securities to interest-earning assets represents another measure of the riskiness of the bank's portfolio. Calomiris and Mason (2003) point out that banks may have been compensated for the lower return of securities with lower risk. Real estate holdings and non-performing loans are also expressed as a share of total assets, although their values are small relative to the other balance sheet components. It is important to recognize that the size of non-performing loans represent an unpredictable outcome of existing loans, not an active element in managers' decisions to structure the balance sheets.

¹⁷A bank that holds more capital relative to its total assets will have lower insolvency risk since the capital will provide a reserve from which to absorb losses to assets (Mishkin and Serletis 2004, p. 202).

3.2 Summary Statistics

Table 1 displays the unweighted means of the balance sheet ratios for different categories of banks defined according to their status in mergers or failures. These figures provide an initial indication of how the balance sheet characteristics of banks that failed and banks that were absorbed in mergers differed from one another and from predator banks. Columns (1)–(3) show the average balance sheet components for (i) failed banks, (ii) acquired banks, and (iii) predator banks for the year of failure or merger. Columns (4)–(5) and columns (7)–(8) report 3-year averages and 5-year averages, respectively, prior to failure or merger.¹⁸ The figures suggest that banks absorbed in mergers tended to be small. Predator banks (at \$103 million) were on average 8.6 times larger than the banks they acquired (at \$12 million) in terms of total assets. The result is similar to the 11 fold difference for London banks found by Collins and Baker (2001). Although Collins and Baker (2001) showed that London predator banks were considerably more liquid than the provincial banks they acquired, only a small difference is observed for Canadian banks. More notably, Canadian predator banks held a smaller share of loans than the banks they acquired, with 58 percent of assets compared to 68 percent in the three years prior to the mergers. Furthermore, predator banks held more securities, 22 percent of assets compared to 12 percent, and less equity, 12 percent of assets compared to 19 percent. These figures are consistent with the idea that predator banks sought to increase their profitability by acquiring banks with high loan-to-asset and capital-to-asset ratios.

¹⁸Multi-year averages are not calculated for predator banks because they often absorbed banks in consecutive years, making it difficult to identify years prior to and after mergers.

The presence of non-performing loans stands out as a key distinguishing feature of banks that failed. Loans that failed to make interest payments represented 9 percent of total loans in the three years prior to failure and 20 percent of total loans in the year of failure. Failing banks were even smaller than banks absorbed in mergers with an average of \$3.3 million in total assets. The balance sheets of banks that failed were characterized by high asset risk, with loans representing 71 percent of total assets, a figure that declined from an 80 percent average in the 5 years prior to failure. On average, failing banks also had higher capital-to-asset ratios (25 percent). While these figures represent unweighted means, they indicate that, in some cases, failing banks did not have a shortage of capital. Instead, excessive risk from a high degree of illiquid asset holdings was a significant problem for failing banks.

4 Historical Background

The Canadian banking system experienced remarkable growth from 1890 to 1920 as it underwent extensive structural change. Figure 1 plots the expansion of the banking system reflected by the log of total assets and the log of the number of bank branches. The balance sheets of the chartered banks and the branch banking networks expanded steadily during the period of study. The banking system contracted briefly during the financial crisis of 1907 and during World War One, and more substantially during the Great Depression. Bank assets also contracted during the deflation of the early 1920s when the decline in world wheat prices severely reduced incomes of western farmers.¹⁹ The increasing concentration of assets and deposits among the

¹⁹McIvor (1958, p. 119).

four leading banks – Bank of Montreal, Canadian Bank of Commerce, Royal Bank and Bank of Nova Scotia – was a key feature of the structural change in the Canadian banking system. Figure 2 plots the Herfindahl-Hirschman Index (HHI), a measure of bank concentration in terms of assets or deposits, for the Canadian banking industry from 1892 to 1941. The index value for each year is given by:

$$HHI = \sum_{i=1}^n \left(\frac{v_i}{V}\right)^2 \quad (1)$$

where v_i is the value of assets or deposits held by bank i and V is the total value of assets or deposits in the banking system. From 1892 to 1900 the Herfindahl index ranged between 6 and 7 percent, before rising gradually to 11 percent in 1920 and then rapidly to 18 percent by 1927 during the latter stages of the merger movement. The inverse of the HHI represents the number of equal-sized banks that would produce the identical Herfindahl index to the actual distribution. The equivalent number of equal-sized banks declined from 14 to 5 during the period, while the actual number of banks declined from 41 to 10.

Figure 3 shows time-series plots of three balance sheet ratios for the Canadian banking system. The loans-to-asset ratio fell noticeably during World War One and the Great Depression, and generally moved inversely with the share of securities in total assets. The initial decline reflected a drop in commercial loans and an increase in the purchase of short-term government treasury bills to finance the war.²⁰ According to McIvor (1958, p. 129), the latter shift in the asset ratio reflected the restrictive lending practises of banks and the movement into securities as banks sought

²⁰McIvor (1958, p. 108).

to maintain earnings. The capital-to-asset ratio declined steadily over time, a pattern consistent with the arguments of Grossman (2007). Bank capital provides a reserve that could be used to liquidate unpaid debts when faced with a shortfall in cash flows and creates incentives to take less risk. The reduction of information asymmetry and the strengthening of reputation effects as a country's financial institutions become more sophisticated are likely to reduce the capital requirement needed to satisfy depositors and investors.²¹ The decreasing capital-to-asset ratio provides an indication of improved banking system stability as banks could maintain a higher degree of leverage.

The rapid expansion of chartered bank balance sheets and the structural changes in the Canadian banking system shown in Figures 1 and 2, as well as the performance of the banks during the Great Depression, have drawn considerable attention and debate from previous literature. While studies such as Bordo, Rockoff and Redish (1994) and Bordo et al. (1996) have examined the Canadian banking system at the aggregate level, a wealth of bank level data remains open to further analysis. The variation in the balance sheet ratios, shown at the aggregate level in Figure 3, between predator, prey and failing banks can provide insight into the process of banking sector consolidation during the merger wave in Canada.

²¹Grossman (2007, pp. 142-144).

5 Determinants of Balance Sheet Ratios

5.1 Model Selection

The results based on comparing unweighted means and summarized in Table 1 provide an initial indication of differences in balance sheet structure, but they lack statistical rigor. To complement the findings, I test for statistically significant differences in the structure of the balance sheets of failed and acquired banks while controlling for other determinants of the balance sheet ratios. I regress the balance sheet ratios on a constant, banking system and macroeconomic characteristics, and dummy variables that take the value of 1 for the year of failure or merger and 0 otherwise. I also include structural breaks in 1900, 1913, 1923 and 1935, to account for changes in banking regulation, and a time trend as covariates. The i th equation of the multivariate linear regression model takes the following form:

$$\begin{aligned} Ratio_{it} = & \beta_0 + \beta_1 failyr_{it} + \beta_2 preyyr_{it} + \beta_3 ltotass_{it} \\ & + \beta_4 lage_{it} + \beta_5 hhidep_t + \beta_6 hobic_i + \beta_7 hoprar_i + \beta_8 hoque_i \\ & + \beta_9 hoatl_i + \beta_{10} growth_t + \beta_{11} ba1900_t + \beta_{12} ba1913_t \\ & + \beta_{13} ba1923_t + \beta_{14} boc_t + \beta_{15} trend_t + \beta_{16} trend2_t + \epsilon_{1t}, \end{aligned}$$

where i , bank indicator; t , time indicator; $Ratio_{it}$, balance sheet component (loans/assets, capital/assets, cash/deposits, securities/interest-earning assets, deposits/capital), β_j , parameters to be estimated; $failyr_{it}$ and $preyyr_{it}$, dummy variables taking the value 1 for failed and acquired banks in the year of failure and merger, respectively, and 0 otherwise; $ltotass_{it}$, log of total assets; $lage_{it}$, log of bank age; $hobic_i$, $hoprar_i$, $hoque_i$, and $hoatl_i$, dummy variables that take the value of 1 if the bank's head office is located

in the region of British Columbia, the Prairies, Quebec, and the Atlantic provinces, respectively and 0 otherwise; $growth_t$, the annual growth rate of real GNP in Canada; $ba1900_t$, $ba1913_t$, $ba1923_t$, and boc_t , dummy variables that take the value of 1 in the years 1892-1900, 1901-1913, 1914-1923, and 1892-1934, respectively, and 0 otherwise; $trend_t$ and $trend2_t$, a linear time trend and the quadratic of the trend; and ϵ_{1t} , error term.

Given that bank managers determined the distribution of assets and liabilities across different balance sheet categories in a set of joint decisions, ϵ_{it} , the error term for observation t of equation i is likely correlated with ϵ_{jt} , the error term for observation t of equation j .²² For example, a shock that affects the desirability of holding loans is likely to affect the decision to hold a certain share of liquid assets. To account for the probable heteroskedasticity in the errors and the similarities in the dependent variables, I estimate the determinants of the balance sheet ratios in a system of equations using the seemingly unrelated regression method.²³

The hypotheses proposed by previous studies suggest that the structure of banks' balance sheets should differ depending on bank size, the level of competition and macroeconomic shocks. Small banks have a comparative advantage in delivering relationship-lending services with high transactions costs to smaller, local customers, and therefore tend to hold a higher proportion of risky assets. Therefore, the coefficient for the log of total assets in the equation with the loans-to-assets ratio as the dependent variable is predicted to be negative. Institutions with market power

²²Although the model specifies that errors may be correlated at time t , it assumes homoskedastic and independent errors across t (Davidson and MacKinnon 2004, p. 502).

²³Keay and Redish (2004) employ a similar method to estimate the determinants of the balance sheets for North American steel firms.

have the incentive to choose a low risk loan portfolio to avoid risk, preserve their charter value, and improve the quality of their portfolios through screening. On the other hand, a “too big to fail” mentality and an improved diversification strategy may lead them to take on more risk and increase their loan-to-asset ratio.²⁴ Thus, the Herfindahl-Hirschman Index measured by deposits will have an ambiguous effect on the loans-to-assets ratio. The annual growth rate of real GNP captures the overall macroeconomic environment in Canada. Calomiris and Wilson (2004) develop a model in which differences in the cost of raising equity account for shifts in the holdings of risky assets and the capital-to-asset ratio to maintain low-risk deposits. The model predicts that negative macroeconomic shocks reduce bank capital while economic expansions coincide with greater lending and a reduction in the holdings of liquid, riskless assets such as cash and government securities.

I construct a categorical variable for the region of the bank’s head office.²⁵ Given that the head offices of the large banks were located in Toronto and Montreal, the variable serves as a proxy for the extent of a bank’s branching network. Banks with head offices in British Columbia, the Prairies and the Atlantic were predominantly regional. The variable provides an imperfect proxy for the regional distribution of branches given that it fails to distinguish between the small regional banks and large banks with nationwide branching networks in Ontario and Quebec.²⁶ In the

²⁴Berger, Demirguc-Kunt, Levine and Haubrich (2004), Neuberger (1998), and Northcutt (2004)

²⁵The five regions are British Columbia, the Prairies, Ontario, Quebec and Atlantic Canada. The Prairies include Manitoba, and after 1905, Alberta and Saskatchewan. The Atlantic region includes Nova Scotia, New Brunswick and Prince Edward Island.

²⁶The regional distribution of bank branches would be more effective, but the data was not accessible for the entire period. I collected data for available years from the *Canada Yearbook* and filled in missing years from the nearest observation. In most cases this approach was reasonably accurate since the regional shares did not vary much over time, except for banks that absorbed banks through

estimation I exclude Ontario and thus the coefficients are interpreted as the effect of having a head office in a particular region relative to Ontario.

The inclusion of structural breaks captures the effect of changes in bank regulation. Since I exclude the dummy variable for the years 1924-1941, the other coefficients for structural breaks are interpreted as effects relative to this time period. A notable change that affected holdings of capital occurred prior to the sample period. The 1890 Bank Act revision raised the minimum paid-in capital requirement of banks to \$250,000, which had to be obtained within one year of receiving a charter. The change in policy, implemented in response to the difficulties of small banks with specialized and localized operations, restricted the entry of new banks.²⁷ The 1913 Bank Act revision made permanent a provision introduced temporarily in 1908 which authorized banks to issue notes beyond the legal limit during the crop moving season when the demand for credit was high in the west. The Bank Act revision also introduced a shareholders' audit to limit opportunities for fraud.²⁸ Shortly thereafter, the Finance Act of August 1914 ended the convertibility of Dominion notes to gold as Canada abandoned the gold standard.²⁹ The revision of the Bank Act in 1923 did not implement any significant changes to the regulation of the banking system. However, the failure of the Home Bank in 1923 prompted the appointment of an Inspector-

mergers. The coefficients for the regional share of branches, along with an HHI of regional shares, were insignificant in the survival analysis regressions, suggesting that the extent of branch banking networks did not affect the timing of bank failures and mergers.

²⁷Bond and Shearer (1972, p. 259) and McIvor (1958, p. 77).

²⁸Bond and Shearer (1972, p. 264). Notes issued in excess of the legal limit—the value of paid-in capital and reserve fund—were required to be matched with deposits of gold or Dominion notes in the Central Gold Reserves (McIvor 1958, p. 84).

²⁹McIvor (1958, p. 103).

General, who gave annual reports on the status of banks to the Minister of Finance.³⁰

In response to regulatory changes banks may have chosen to restructure their balance sheets. For example, the coefficient on the Bank Act dummy prior to 1913 in the regression on the cash-to-deposit is predicted to be negative, given the allowance to issue notes beyond the legal limit following the regulatory revision. I also include a linear time trend to capture the effect of increased technological sophistication in financial intermediation and the determination of risk. The quadratic term captures non-linearities in the effect of technological change.

5.2 Results

Table 2 reports the results for Equation 2 estimated by the seemingly unrelated regression technique. Banks that failed and banks absorbed in mergers did not have statistically significant differences in the structure of their balance sheets in the year prior to failure or acquisition, with the exception of “prey” banks which held a greater portion of interest-earning assets as securities. However, the condition of a bank immediately before its demise may not provide a complete sense of the structural characteristics of its portfolio associated with its vulnerable state. Therefore, I also report results where the dummy variables $prey_{3it}$ and $fail_{3it}$ take the value of 1 for each of the final three years before merger or failure, respectively, to account for the structure of the balance sheets during an acquisition or failure phase.³¹ The approach is similar in motivation to the methods of Pasiouras and Gaganis (2007) who argue

³⁰McIvor (1958, pp. 119–120).

³¹While I only report results for a three year acquisition or failure phase, I obtain consistent findings when the dummy variables take the the value of 1 in the final two, four or five years prior to merger or failure.

that the likelihood of failure and the attractiveness of acquisition targets depended upon the bank characteristics in the years leading up to the event.³² Therefore the acquisition or failure phase provides a reasonable representation of a bank in distress.

With the exception of the loans-to-assets ratio, the results show statistically significant differences in the balance sheet composition of failed and acquired banks in the three years leading up to the event.³³ Both categories of banks had significantly lower capital-to-assets and cash-to-deposits ratios, which suggests that these banks had concerns with liquidity and faced the threat of insolvency. The allocation of risk within the portfolio of interest-earning assets represents a feature that distinguished banks that failed from banks absorbed in mergers. Securities comprised a significantly smaller share of interest-earnings assets for banks nearing failure, which represented a riskier portfolio composition. The opposite held true for banks facing the prospect of acquisition.

The results in Tables 2 and 3 also indicate that large banks, measured by the log of total assets, had a preference for a lower risk portfolio as they held a smaller share of total assets in loans and a larger share of interest-earning assets in securities. These findings are consistent with the arguments of Neuberger (1998). Moreover, the insignificant effect of banking sector concentration on the loans-to-asset ratio is consistent with the opposing effects suggested by the competition-stability and competition-fragility views and discussed by Berger et al. (2004). The result that the cash-to-deposit ratio declined significantly as the banking system became

³²I discuss their method further in Section 6.1.

³³The differences in the coefficients of other variables included in the regressions between the two sets of results are minimal. Throughout the paper, event refers to a bank-year observation where the bank has failed or been acquired in a given year.

more concentrated provides indirect support for the diversification effect of mergers hypothesized by Carletti, Hartmann and Spaglolo (2007, pp. 1070-1071) whereby the pooling of idiosyncratic liquidity shocks lowers the expected liquidity needs of banks. Newly established banks had significantly lower capital-to-asset and securities-to-risky asset ratios, and a higher loan-to-asset ratio, which indicates that banks took on riskier portfolios as they sought to establish their business.

The coefficient for the growth rate of real GNP is insignificant in all regressions, a perplexing result that does not correspond to the theoretical arguments of Calomiris and Wilson (2004). The contemporaneous growth rate of real GNP may not effectively capture the effect of macroeconomic instability if banks adjust their balance sheets with a lag. Seasonal variation in the balance sheet components cannot be distinguished from long-run business cycle variation given that the data is only recorded at an annual frequency. The time horizon of decisions to determine the balance sheet ratios may have varied among the individual components. The cash-to-deposits ratio, a measure of liquidity, likely adjusted in response to seasonal demands and changes in the ratio would not correspond to the annual GNP growth rate. Given that loans are a relatively illiquid component of bank assets, the loans-to-asset ratio may have responded to lagged values of GNP growth. Furthermore, the balance sheet components may have responded to an unobserved expected GNP growth rate instead of the observed growth rate.

The coefficients on the region of head office are generally significant. Banks with head offices in British Columbia, Quebec, and Atlantic Canada had higher capital-to-asset and cash-to-deposit ratios relative to banks with head offices in On-

tario. These results are consistent with the notion that the rural-based business of regional banks required greater liquidity and protection from insolvency risk. Banks with head offices outside Ontario also held a smaller share of interest-bearing assets as securities, a result which suggests that banks located in the financial center had better access to capital markets in order to hold securities.

The results for the determinants of balance sheet ratios indicate statistically significant differences in the years leading up to bank failures and acquisitions. They also confirm theoretical arguments that large banks prefer a less risky allocation of assets. While these findings highlight the *ex ante* differences in the balance sheet structure of failed and absorbed banks, they do not reveal whether these differences contributed to the variations in the likelihood and timing of failures and mergers. I return to this question in the following sections using a different empirical framework.

6 Determinants and Bank Mergers and Failures

The balance sheet data can be categorized according to each bank's involvement in mergers or failures in a particular year. The sample contains all 52 Canadian chartered banks that operated between 1892 and 1931 and includes all 30 banks absorbed in mergers and all 12 banks that failed during the period. The dates of bank mergers are taken from Beckhart (1929), while the dates of bank failures are collected from Holladay (1938).³⁴ The event of a bank merger is defined by the actual date of the bank absorption when the Order-in-Council authorized the merger, not the initial date of agreement. Cases where banks were renamed or rechartered are not counted

³⁴Both sources are supplemented with data from the appendices of Noiseux (2002) and Kryzanowski and Noiseux (2002).

as mergers. Therefore, the Merchants Bank of Halifax and the Royal Bank are considered the same entity, along with the Banque d’Hochelaga and Banque Canadienne Nationale, as well as the Banque Jacques-Cartier and Banque Provinciale. The event of a bank failure is defined by the date when payments were suspended or normal operations were terminated. Often a bank remained listed in the balance sheet reports for a few years after the suspension of payments while their assets were liquidated and regulatory conditions were imposed. These observations are dropped in the estimation process. The period of study is only extended until the end of 1931 because no bank failures or mergers are observed after that point in time.

6.1 Model Selection

I evaluate the effect of balance sheet ratios on the likelihood and timing of bank mergers and failures using two estimation methods: a multivariate logit regression model and survival duration analysis. The logit regression procedure parallels the work of Hannan and Rhodes (1987), Amel and Rhodes (1989), and Pasiouras and Gaganis (2007). I estimate four versions of the multivariate logit regression model in the following form:

$$\begin{aligned}
 E(y) = & f[\beta_0 + \beta_1 \log assets_{it} + \beta_2 loans\ to\ assets_{it} \\
 & + \beta_3 securities\ to\ interest\ earning\ assets_{it} \\
 & + \beta_4 capital\ to\ assets_{it} + \beta_5 cash\ to\ deposits_t \\
 & + \beta_6 bad\ loans\ to\ total\ assets_{it} + \beta_7 real\ estate\ to\ assets_t \\
 & + \beta_8 \log\ age_{it} + \beta_9 hhidep_t + \beta_{10} growth_t + \beta_{11} hobc_i \\
 & + \beta_{12} hoprar_i + \beta_{13} hoque_i + \beta_{14} hoatl_i + \beta_{15} ba1900_t],
 \end{aligned}$$

where $E(y)$ is the probability that $y = 1$. The dependent variable y is defined to equal one if a bank is acquired in year t in model (1) and is equal to one in model (3) if a bank fails in year t . In each case, a positive coefficient indicates that an increase in the independent variable is associated with an increase in the likelihood of acquisition or failure. As discussed in Section 5.2, the bank characteristics in the years leading up to an event may provide additional information about the likelihood of failure.³⁵ Thus, in models (2) and (4) the dependent variable is equal to one if a bank is in the final three years prior to a merger or failure, respectively.³⁶ In these models the coefficients in the logit regression can no longer be interpreted as differences in the predicted probabilities of failure or acquisition. Instead, the coefficients are interpreted as changes in the probability of entering a failure or acquisition phase of three years. The balance sheet variables are defined in Section 3.1 and other covariates are the same as those defined in Equation 2.

The hypotheses presented in the theoretical finance literature provide a basis for the predictions regarding the effects of balance sheet ratios on the likelihood of bank mergers. The sign of the coefficient on the loan-to-asset ratio is ambiguous since a logical argument can be made in favor of either a positive or negative effect. The strong customer relationships signaled by a high ratio of loans and the conservative management strategy indicated by a low share of loans could both characterize a

³⁵Pasiouras and Gaganis (2007, p. 334, n. 8) make a similar point in arguing that “the financial characteristics that make a bank [an] attractive target... should be evident prior to the acquisition decision.” In their logit regressions they take the average of independent variables over the two years before the acquisition for observations where the dependent variable is equal to one.

³⁶Results with similar significance levels held when the dependent variable was equal to one for other ranges of years prior to the event.

favorable target for acquisition.³⁷ The directional effect of the capital-asset ratio on the likelihood of bank mergers is also unclear. Predator banks may find potential targets with high capital-asset ratios attractive since they could reduce the amount of capital and increase profitability. On the other hand, banks with low capital-to-asset ratios are in a weak position and can be acquired at a low price.³⁸ The qualitative observations of the existing literature on Canadian bank mergers suggests that smaller banks were more likely targets for acquisition.

Relative to bank mergers, the anticipated effect of balance sheet ratios on the likelihood of bank failure is more obvious. The log of a bank's total asset represents bank size. Large banks are capable of reducing asset risk by achieving better diversification of their loan portfolio, often through branch networks.³⁹ Large banks should be less at risk of failure and thus the coefficient on the log of total assets should be negative. A higher share of assets in loans is likely to increase the probability of failure because loans are the most illiquid and highest risk category of assets. Given that equity provides security against loan losses and declines in asset value, the coefficient on the capital-to-asset ratio is predicted to be negative.⁴⁰ To provide indicators of the riskiness and quality of a bank's assets I also include the ratio of real estate holdings to total assets and the ratio of non-performing loans to total assets. These components are expected to increase the likelihood of failure given that a poor quality loan portfolio would generally be illiquid. In addition, these variables assist in distinguish-

³⁷Hannan and Rhodes (1987, p. 71).

³⁸Amel and Rhodes (1989, p. 19) and Mitchener and Carlson (2009, p. 188). Similar arguments for an effect of ambiguous sign applies to the market share variable, represented by the HHI index for deposits in the logit analysis.

³⁹Calomiris and Mason (2003, p. 1630).

⁴⁰Wheelock and Wilson (2000, p. 131).

ing candidates for merger or failure. I also include the age of the bank to capture charter value, managerial experience and reputation effects, which are predicted to reduce the likelihood of failure.

Regulatory changes also influenced the structure of banks' balance sheets and the timing of mergers. I include a dummy variable for a structural break in 1900. The 1900 Bank Act amendment drastically simplified the process of arranging mergers as it allowed a bank to purchase the assets or shares of another bank and eliminated the need for a special Act of Parliament. A further Bank Act amendment in 1913 required a written agreement from the Minister of Finance in order for banks to negotiate an amalgamation, but this represented a mere formality and did little to slow down the merger movement.⁴¹ Given that the other Bank Act amendments discussed earlier did not directly address bank mergers, structure breaks for the years of their introduction are not included in the analysis. The predicted effect of the head office variables on the likelihood of mergers and failures is positive for regions apart from Quebec since a regional bank with less diversification of assets is more susceptible to shocks.

Although the logit regressions identify the factors that affect the probability that a bank will eventually merge or fail, they do not provide insight into the timing of the events. The survival duration analysis follows the methods used by Mitchener and Carlson (2009), Wheelock and Wilson (2000) and Calomiris and Mason (2003). The dependent variable in the regressions is the time from exposure to risk until the event (failure or merger) is realized, or until the particular bank is censored by exiting the sample in 1931. As Carlson (2004) indicates, the length of survival

⁴¹Carr et al. (1995, p. 1143).

contains more information than the binary variable used in the logit regressions. Each bank observation is defined by a survival duration from the date the balance sheet characteristics are observed until an event takes place or the balance sheet variables are updated a year later. I estimate the following equation:

$$\begin{aligned}
Survival\ time_i = & f[\beta_0 + \beta_1 \log\ assets_{it} + \beta_2 \text{loans to assets}_{it} \\
& + \beta_3 \text{securities to interest earning assets}_{it} \\
& + \beta_4 \text{capital to assets}_{it} + \beta_5 \text{cash to deposits}_{it} \\
& + \beta_6 \text{bad loans to total loans}_{it} + \beta_7 \text{real estate to loans}_{it} \\
& + \beta_8 \log\ age_{it} + \beta_9 \text{hhidep}_t + \beta_{10} \text{growth}_t + \beta_{11} \text{hobc}_i \\
& + \beta_{12} \text{hoprar}_i + \beta_{13} \text{hoque}_i + \beta_{14} \text{hoatl}_i + \beta_{15} \text{ba1900}_t],
\end{aligned}$$

where $Survival\ time_i$ is the time until merger in models (1) and (2), and the time until failure in models (3) and (4). Depending on the estimated model, an event is defined as a bank merger or failure that occurred between June 1892 and June 1931. In estimations (1) and (3), banks are initially exposed to risk when they enter the data set, the year of which varies for each bank. However, many banks are observed for over 25 years before a failure or merger occurs. Given the long period of survival, one could argue that these banks were not exposed to the risk of failure or acquisition throughout the entire sample. Therefore, in separate estimation (2) and (4), I restrict the period of exposure to risk to a “failure phase” that begins ten years prior to the occurrence of the event or the censoring of the observation.

While previous studies have measured survival time in days, I choose to measure the time until the event in months, given that the covariates have annual fre-

quency.⁴² The survival time dependent variable corresponds to the beginning of the duration spanned by the independent variables. Following Mitchener and Carlson (2009), I assume that the hazard rate exhibits a log-logistic distribution, which allows the hazard rate to first increase over time to a peak, before decreasing as time approaches infinity. In survival analysis, a negative coefficient is interpreted as a reduction in the time until the event occurs due to a unit increase in the independent variable. A transformation of β by $100 \times [\exp \beta - 1]$ gives the percentage change in the expected time until the event occurs.⁴³ The intuitive arguments for the predicted effects of balance sheet ratios carries over from the logit regression analysis, although the signs on the coefficients will be reversed.

6.2 Results

The results for the logit regressions, reported in Table 4, indicate that banks absorbed in mergers and failed banks tended to be small. This contrasts the findings of Hannan and Rhodes (1987) and Amel and Rhodes (1989) who find no significant effect of bank size as measured by the log of total assets for U.S. banks in the 1970s and 1980s. Few coefficients in columns (1) and (3) are statistically significant in relation to the coefficients in columns (2) and (4), which suggests that the condition of the balance sheet components in the years prior to failure or merger provide a better representation of a bank in distress. According to Pasiouras and Gaganis (2007, p. 335) outlier observations for independent variables can have a strong influence in logit analysis, a factor that may contribute to the inefficient estimates of the effects

⁴²My results are unaffected by the choice of survival time in months or days.

⁴³Mitchener and Carlson (2009, p. 185).

of the balance sheet variables in the regressions where the binary dependent variable takes the value of one only in the event year. The loans-to-assets ratio did not affect the probability of acquisition, a result consistent with the findings for U.S. banks in the 1970s by Hannan and Rhodes (1987) who suggest that the variable captures the aggressiveness of a bank's portfolio. The negative coefficient on the capital-to-assets ratio suggests there is weak evidence that banks with a larger equity holdings were less likely to be absorbed in mergers.

Regional banks in British Columbia and Atlantic Canada were more likely acquisition targets, a result which captures the expansion of nationwide branching networks. The dummy variable for the Bank Act revision in 1900 is significant as expected. Holdings of non-performing loans had a substantial and significant effect on the likelihood of bank failure and clearly distinguished failed banks from those acquired in mergers. Banks with less capital were also more likely to fail. The insignificant coefficient on the growth rate of real GNP provides support for Neufeld's (1972, p. 104) contention that bank failures resulted from the internal decision of management and not from external macroeconomic factors outside the bank's control.

To some extent, the results for the survival duration analysis differ from the logit regressions, a reflection of the different effects that each method captures. Table 5 highlights the relevant bank characteristics that affected the timing of bank mergers and failures for Canadian chartered banks. When the entire data sample is used in the analysis in column (1), the effect of the balance sheet ratios on the timing of acquisition is insignificant. Given that many banks are observed for a long period of time, the variation in the balance sheet components in the critical phase prior to

acquisition or failure cannot be distinguished from regular variation across business cycles. Instead, the significance lies with the head office variables, which captures the cases of small regional banks that appear in the sample for shorter periods and are absorbed more rapidly than Ontario banks. Similarly, effects of the balance sheet components on the timing of bank failures using the full sample in column (3) are mostly insignificant with the exception of the loans-to-assets ratio.

Columns (2) and (4) report results using truncated data as I restrict the sample of observations to the ten years prior to acquisition, failure or exit from the sample in 1931. Although the restriction is arbitrary it allows the survival estimation to capture the effect of changes in the balance sheet composition during the acquisition or failure phase. These results provide a clear indication of the factors the distinguished banks targeted for acquisition from those that failed. Predator banks favored acquisition targets with less risky loan portfolios as a one percent increase in the loans-to-assets ratio corresponded to a two percent increase in the time until merger. Given that most predator banks were large institutions, the result provides support to Neuberger's (1998) view that banks with market power prefer to avoid risk and choose a portfolio allocation with a smaller share of loans. Perhaps paradoxically, predator banks also had a weak preferences for acquiring banks with a smaller share of securities allocated to interest-earning assets. This may indicate a demand for sufficient earnings potential while maintaining a degree of liquidity. Mitchener and Carlson (2009) obtained a similar result for the acquisition of California banks by large branching networks in the 1920s and 1930s. The evidence also shows that younger banks were more likely acquisition targets, an indication that managerial experience contributed to bank

survivorship.

The logit regressions had shown that banks with lower capital-to-asset ratios were more likely targets for acquisition and candidates for failure. However, in the survival analysis the capital-to-asset ratio has no significant effect on the timing of events. In the case of mergers, this result suggests that predator banks targeted banks with high capital ratios for the prospects of increasing profitability as well as banks with low capital ratios due to the associated low purchase price. While the evidence does not necessarily cast into doubt the arguments of Bordo (1986) and Kryzanowski and Roberts (1993) that the Canadian government encouraged the acquisition of weak and insolvent banks in the 1920s and 1930s, it does suggest that such a view did not represent the sole motivation for Canadian bank mergers. The large Canadian banks did not prefer to take over poorly performing banks nearing insolvency. However, the insignificant result for the effect of non-performing loans provides further indication that they also did not avoid the weaker banks. Mitchener and Carlson (2009) perform tests with bank earnings data which clearly show that large branching networks avoided banks with weakly performing assets as targets for acquisition. Since Canadian predator banks did not avoid nearly insolvent banks they contributed to the improved stability of the banking system by absorbing some of the weaker institutions. The insignificant result for the case of bank failures may indicate that banks did not experience shocks to the capital ratio in the years leading up to failure, relative to other balance sheet components.

Banks with riskier portfolios had a higher probability of failure as a one percent increase in the loans-to-asset ratio reduced the time until failure by 11 percent. Banks

with poor quality and highly illiquid assets were unlikely to survive for a long period. A one percent increase in the share of real estate holdings and non-performing loans shorted the time until failure by 45 and 40 percent, respectively.⁴⁴ These findings are consistent with the significant results for U.S. banks in the 1980s and 1990s reported by Wheelock and Wilson (2000) who used similar indicators of loan risk and quality. Calomiris and Mason (2003) also reported a large negative coefficient for the ratio of real estate holdings to non-cash assets for U.S. banks during the Depression. Thus, the large changes in survival times implied by the results are comparable to previous findings for the U.S. in other periods. The large magnitudes are reasonable since a high share of non-performing loans would have severely compromised the bank's liquidity and made it difficult to avoid insolvency. Moreover, Neufeld (1972, p. 104) has suggested that the revelation of imprudent loans inspired a loss of confidence in the bank on the part of depositors. The significant results for the loan quality measures are consistent with the evidence of fraudulent activity and poor management reported by the literature on Canadian banking. In contrast to the results reported by Calomiris and Mason (2003), I do not find that bank size affected the likelihood of survival. The negative coefficient on the ratio of securities to interest-earning assets is contrary to expectation and suggests that securities were not less risky than loans in Canada, as Calomiris and Mason (2003) and Mitchener and Carlson (2009) had hypothesized for the U.S. during the Great Depression.

⁴⁴The changes in survival times due to increases in the real estate holdings and non-performing loans are significantly large relative to the effects of other balance sheet components. This discrepancy reflects the fact that the illiquid and poor quality loan measures represented much smaller shares of total assets than other balance sheet components, and thus a one percent increase in the ratio was considerable relative to the average ratio.

The applicability of the common distributions used for duration analysis to the data for Canadian banks is a concern. The log-logistic distribution of the hazard rate, which rises over time from zero to a peak before declining as time goes to infinity, may not effectively capture the risk exposure of Canadian banks observed in a healthy state for an extended period prior to their acquisition or failure. Given the polarized nature of the Canadian banking system between the “big four” chartered banks and the remaining banks, the assumption that the hazard rate of all banks follows the same distribution may be too strong. The survival duration model used in this paper does not allow for individual heterogeneity or variation in the hazard rate across banks, and thus a more sophisticated specification may be more appropriate.⁴⁵

7 Conclusion

The results in the paper could be augmented by extending the data to include the 1880s in order to expand the small sample of bank failures. Although taking full advantage of the monthly balance sheets in the *Canada Gazette* may not be feasible, doubling the data to biannual frequency by collecting year-end observations would provide a clearer sense of how the balance sheets composition of banks that failed and were targeted for acquisition may have shifted in the years prior to their demise. Moreover, collecting monthly data for a short period would permit more thorough analysis of a particular period such as the Great Depression or the peak years of the merger movement. A focused analysis of this nature could address more specifically the question of why Canadian chartered banks did not fail during the

⁴⁵See Davidson and MacKinnon (2004, pp. 494-495) for suggested references.

Great Depression. Possible econometric extensions include the modification of the distributional assumptions for the hazard rate to better capture the long period of survival for many banks and the possible heterogeneity in the acquisition and failure risk across institutions, particularly the large chartered banks.

The empirical results in this paper provide support to the theoretical expectations of how balance sheet structure should depend on the characteristics of the bank. In particular, large banks preferred lower risk portfolios and the liquidity of banks' balance sheets declined as the system became more concentrated. Although the logit regressions and survival duration analysis produced some ambiguous results, the findings rule out certain extreme views that the previous literature on Canadian bank mergers and failures has offered. Predator banks did not exclusively target nearly insolvent or strongly performing banks, but did not avoid them either. The finding suggests that the merger movement eliminated some of the weakest banks, thereby improving the stability of the Canadian banking system. The arguments that the Canadian government encouraged the merger of poorly performing banks and that predator banks weakened the competition in the banking system provide an incomplete perspective of the motives for mergers and determinants of failures. The results also provide empirical verification for some commonly perceived notions regarding bank mergers and failures in Canada. Banks acquired in mergers tended to be small while the significant effect of non-performing loans on the likelihood of failure suggests the involvement of fraud and mismanagement that has often been cited in the literature.

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A Balance Sheet Components

The categories of the banks' balance sheets display in the *Canada Gazette* changed frequently between 1892 and 1941. The following list contains the balance sheet headings that appeared at different points in time and allocates them to the categories that underlie the balance sheet ratios analyzed in the paper.

Assets

- *Cash*

- Dominion notes (1892-1934); Notes of Bank of Canada (1935-1941).
- United States and other foreign currencies (1924-1934); Government and bank notes other than Canadian (1935-1941).
- Notes and cheques on other banks (1892-1913); Notes of other banks (1914-1934); Notes of other chartered banks (1935-1941); Cheques on other banks (1914-1941).

- *Near Cash*

- Specie (1892-1913); gold and coin (1914-1934); gold held in Canada, subsidiary coin held in Canada, gold held elsewhere, subsidiary coin held elsewhere (1935-1941) .
- Deposits for security of note circulation (1892-1941); deposits in central gold reserves (1914-1934); deposits with Bank of Canada (1935-1941).
- Deposits with banks in Canada, balances due from other banks in Canada in daily exchanges (1892-1900); Deposits made with and balances due from other banks in Canada (1901-1941); balances due from foreign banks, balances due from banks in the UK (1892-1941).

- *Securities*

- Dominion government securities (1892-1900); Dominion and provincial government securities (1901-1934); Dominion and provincial government securities maturing within 2 years, other Dominion and provincial government securities (1935-1941).
- Canadian municipal and foreign securities, railway securities (1892-1934); Canadian municipal securities, public securities other than Canadian (1935-1941); other bonds, debentures and stocks (1935-1941).

- *Loans*

- Call loans (1892-1900); Call and short loans in Canada, Call and short loans elsewhere (1901-1941).
- Current loans (1892-1900); current loans in Canada, current loans elsewhere (1901-1941).

- Loans to government of Canada, loans to provincial government (1892-1941).
- Loans to cities, towns, municipalities and school districts (1914-1941).
- Shares of and loans to controlled companies (1924-1941).
- *Illiquid assets*
 - Overdue debts (1892-1923), estimated loss from non-current loans (1924-1941).
 - Real estate, mortgages, bank premises (1892-1941).
- *Other components ignored*
 - Loans to other banks in Canada including bills discounted, other assets, liabilities of customers under letter of credit

Liabilities

- *Deposits*
 - Balances due to Dominion government, balances due to provincial government (1892-1941).
 - Public demand deposits, public notice deposits (1892-1900).
 - Public demand deposits in Canada, public notice deposits in Canada, deposits elsewhere than in Canada (1901-1941).
 - Deposits by banks in Canada, balances due to banks in Canada in daily exchanges (1892-1900); deposits made by and balances due to banks in Canada (1901-1941).
 - Balances due to UK banks, balances due to foreign banks (1892-1941).
- *Capital*
 - Capital paid up, rest or reserve fund (1892-1941).

B Figures and Tables

B.1 Figures

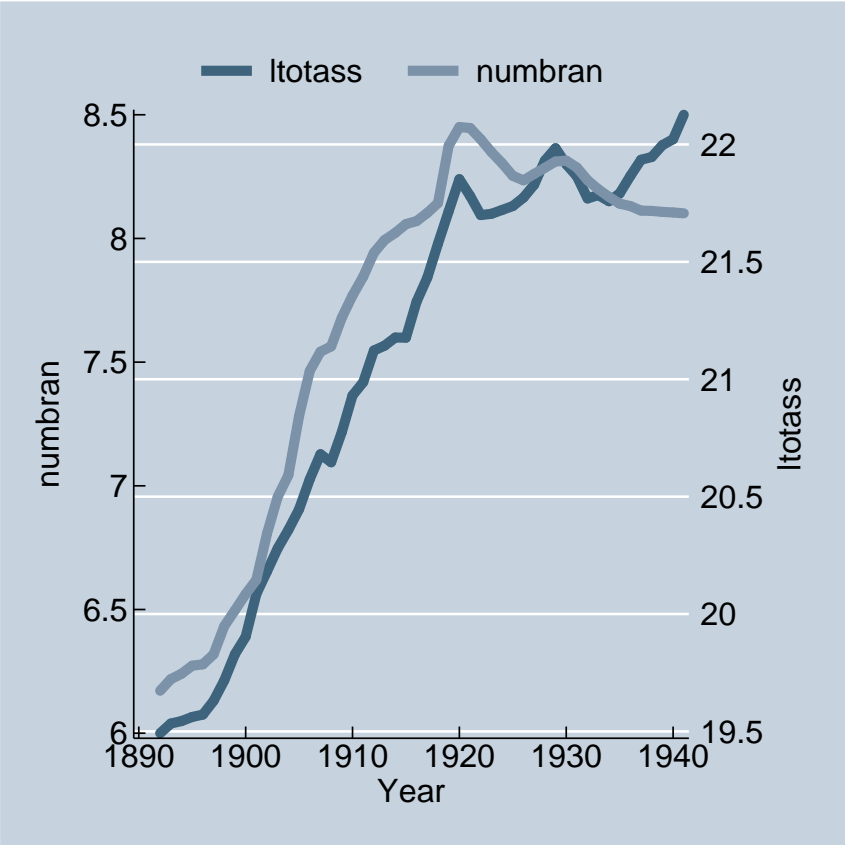


Figure 1: Growth of Canadian Banking System
Source: Urquhart and Buckley, eds (1965).

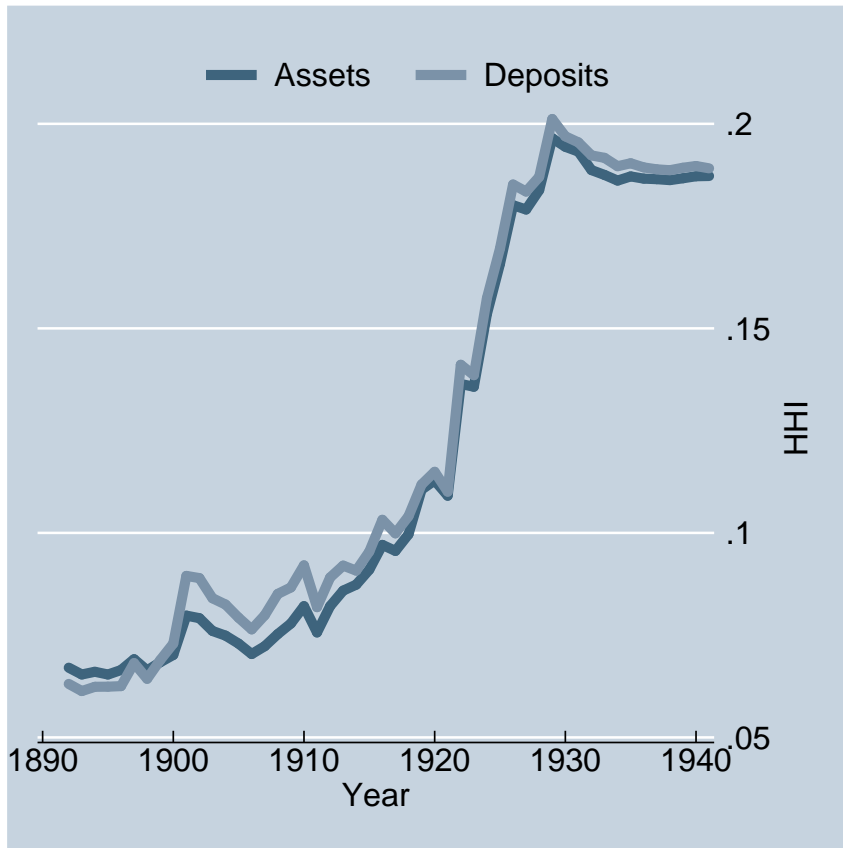


Figure 2: Herfindahl-Hirschman Index of Bank Concentration
 Source: Author's calculations.

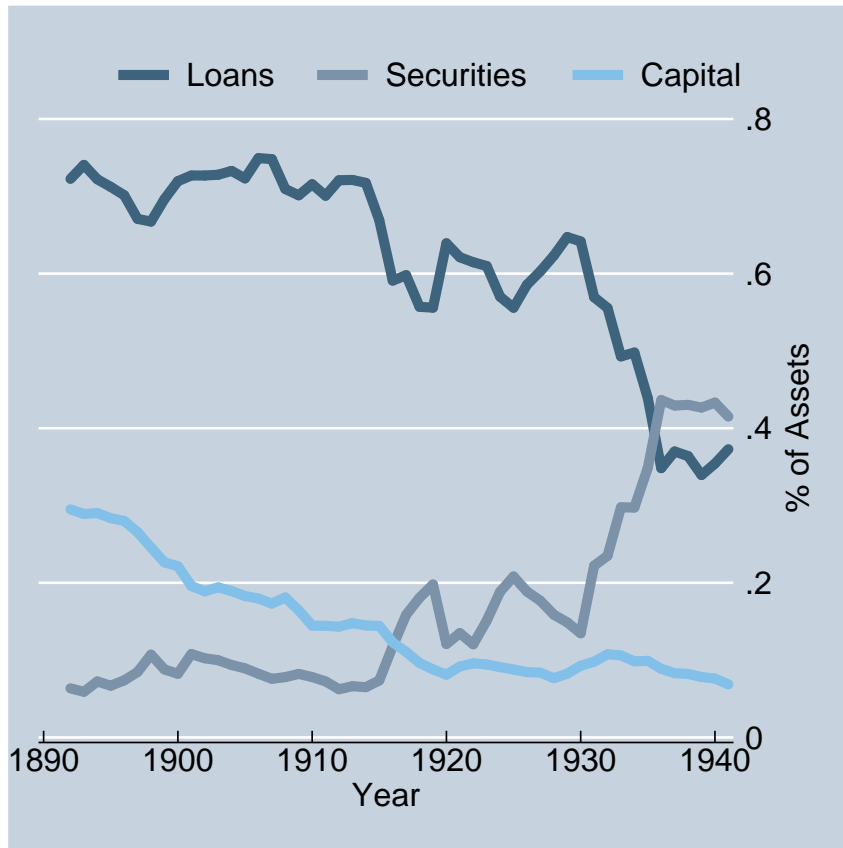


Figure 3: Balance Sheet Ratios
 Source: Author's calculations.

B.2 Tables

Table 1: Balance sheet ratios of failed and acquired banks prior to event

Balance sheet ratio	Year of event			3 Yr. Avg. before event			5 Yr. Avg. before event		
	Failed bank	Prey	Predator	Failed bank	Prey	Predator	Failed bank	Prey	Predator
Loans to assets	0.71	0.66	0.67	0.74	0.68	0.68	0.80	0.68	0.68
Securities to assets	0.06	0.14	0.11	0.05	0.12	0.12	0.05	0.12	0.12
Capital to assets	0.25	0.19	0.14	0.25	0.19	0.19	0.25	0.20	0.20
Cash to deposits	0.09	0.11	0.13	0.10	0.11	0.11	0.10	0.11	0.11
Deposits to capital	3.17	4.89	6.69	3.10	4.96	4.96	3.10	4.80	4.80
Bad loans to loans	0.21	0.01	0.00	0.09	0.01	0.01	0.06	0.01	0.01
Log total assets	15.01	16.31	18.46	15.01	16.29	16.29	14.95	16.24	16.24

Source: The data on the balance sheet components are collected from the *Canada Gazette* (1892–1931).

Table 2: Determinants of balance sheet ratios (year of event)

	Loans/ Assets (1)	Capital/ Assets (2)	Cash/ Deposits (3)	Securities/ Risky Assets (4)	Deposits/ Capital (5)
failyr	-.012 (.039)	-.019 (.018)	-.017 (.011)	-.021 (.023)	.283 (.415)
preyyr	-.023 (.025)	-.015 (.011)	-.007 (.007)	.027* (.015)	.388 (.266)
Log assets	-.015‡ (.004)	-.028‡ (.002)	-.015‡ (.001)	.007‡ (.003)	.644‡ (.046)
Log age	.036‡ (.008)	.000 (.004)	-.025‡ (.003)	-.013‡ (.005)	.005 (.090)
HHI (deposits)	-.336 (.605)	-.340 (.275)	-.397† (.178)	.065 (.370)	22.953‡ (6.447)
Head office (BC)	-.061 (.038)	.196‡ (.017)	.085‡ (.011)	-.078‡ (.023)	-1.740‡ (.402)
Head office (Prairies)	.045 (.018)	-.013 (.008)	-.019‡ (.005)	-.057‡ (.011)	.094 (.188)
Head office (Quebec)	-.007 (.011)	.023‡ (.005)	.009‡ (.003)	-.019‡ (.007)	-.473‡ (.116)
Head office (Atlantic)	.006 (.016)	.044‡ (.007)	.020‡ (.005)	-.013 (.010)	-.800‡ (.166)
GNP growth	.048 (.072)	-.032 (.033)	.016 (.021)	.004 (.044)	.600 (.772)
Bank Act 1900	-.011 (.061)	-.045 (.028)	-.010 (.018)	-.045 (.037)	1.918‡ (.646)
Bank Act 1913	.026 (.050)	-.027 (.023)	-.013 (.015)	-.036 (.031)	.962* (.532)
Bank Act 1923	-.030 (.039)	-.029 (.018)	.002 (.012)	.007 (.024)	2.040‡ (.418)
Bank of Canada	.116‡ (.039)	.024 (.018)	.022† (.011)	-.147‡ (.024)	-1.44‡ (.413)
Trend	.000 (.003)	-.007‡ (.001)	.003‡ (.001)	-.004† (.002)	.083‡ (.027)
Trend2	.000 (.000)	.000* (.000)	.000‡ (.000)	.000‡ (.000)	.000 (.001)
Constant	.766‡ (.106)	.759‡ (.048)	-.049 (.031)	.222‡ (.065)	-9.403‡ (1.126)
Observations	1132	1132	1132	1132	1132
R^2	.414	.683	.302	.693	.779

Sources: See Table 1 for balance sheet data. Head office and bank age variables are from Beckhart (1929) and Noiseux (2002). GNP growth is from Urquhart and Buckley, eds (1965).
Notes: The symbols ‡, † and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Estimated as a system of equations using seemingly unrelated regression.

Table 3: Determinants of balance sheet ratios (3 years before event)

	Loans/ Assets (1)	Capital/ Assets (2)	Cash/ Deposits (3)	Securities/ Risky Assets (4)	Deposits/ Capital (5)
failyr3	.015 (.024)	-.023† (.011)	-.012* (.007)	-.035† (.014)	.454* (.252)
preyyr3	-.011 (.016)	-.018‡ (.007)	-.013‡ (.005)	.016* (.009)	.541‡ (.164)
Log assets	-.014‡ (.004)	-.028‡ (.002)	-.014‡ (.002)	.007‡ (.001)	.665‡ (.046)
Log age	.036‡ (.008)	.000 (.004)	-.025‡ (.002)	-.013‡ (.005)	.010 (.090)
HHI (deposits)	-.303 (.606)	-.305 (.274)	-.367† (.178)	.013 (.370)	21.798‡ (6.432)
Head office (BC)	-.064* (.038)	.201‡ (.017)	.088‡ (.011)	-.074‡ (.023)	-1.884‡ (.403)
Head office (Prairies)	.046‡ (.018)	-.012 (.008)	-.019‡ (.005)	-.059‡ (.011)	.080 (.187)
Head office (Quebec)	-.007 (.011)	.023‡ (.005)	.009‡ (.003)	-.019‡ (.007)	-.477‡ (.115)
Head office (Atlantic)	.007 (.016)	.045‡ (.007)	.021‡ (.005)	-.014 (.010)	-.821‡ (.166)
GNP growth	.052 (.072)	-.028 (.033)	.019 (.021)	.000 (.044)	.514 (.768)
Bank Act 1900	-.008 (.061)	-.042 (.027)	-.007 (.018)	-.049 (.037)	1.825‡ (.644)
Bank Act 1913	.027 (.050)	-.023 (.023)	-.011 (.015)	-.037 (.031)	.862* (.530)
Bank Act 1923	-.028 (.039)	-.026 (.018)	.004 (.012)	.004 (.024)	1.947‡ (.417)
Bank of Canada	.115‡ (.039)	.024 (.018)	.022* (.011)	-.145‡ (.024)	-1.431‡ (.412)
Trend	.000 (.003)	-.006‡ (.001)	.003‡ (.001)	-.004† (.002)	.076‡ (.027)
Trend2	.000* (.000)	.000‡ (.000)	.000‡ (.000)	.000‡ (.000)	.000 (.001)
Constant	.754‡ (.106)	.765‡ (.048)	-.046 (.031)	.239‡ (.065)	-9.552‡ (1.125)
Observations	1132	1132	1132	1132	1132
R^2	.414	.685	.306	.695	.781

Sources: See Table 1 for balance sheet data and Table 2 for bank and macroeconomic characteristics.
Notes: The symbols ‡, † and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Estimated as a system of equations using seemingly unrelated regression.

Table 4: Likelihood of bank failures and mergers (logit regressions)

	preyr3		preyr3		failyr		failyr3	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Log assets	-.527*	.279	-.491†	.173	-1.022*	.569	-1.156†	.322
Loans to assets	-.005	.018	-.011	.018	-.004	.010	-.007	.009
Securities to risky assets	.020	.025	.007	.021	-.015	.048	-.059*	.034
Capital to assets	-.057	.046	-.072†	.028	-.134†	.068	-.120†	.039
Cash to deposits	.004	.054	-.036	.036	.031	.089	.024	.050
Bad loans to assets	-.010	.074	-.046	.095	.707†	.262	.518†	.164
Real estate to assets	-1.127	.164	-.211	.188	.222	.244	.064	.163
Log age	-.147	.416	-.218	.252	.264	.750	.291	.426
HHI (deposits)	.072	.071	.073	.047	-.221	.281	-.165	.186
GNP growth	-.022	.031	.021	.021	.022	.065	.010	.038
Head office (BC)	1.927	1.347	3.252†	1.124	-.163	2.152	1.348	1.269
Head office (Prairies)	.493	.710	.614	.441	-.979	1.362	-1.474	.917
Head office (Quebec)	.409	.619	.288	.374	-1.380	1.254	-.144	.724
Head office (Atlantic)	1.551†	.764	1.638†	.462	-1.942	1.766	-2.059†	1.042
Bank Act 1900	-2.921	1.068†	-2.063	.454†	-1.736*	1.046	-2.059†	.637
Constant	6.095	4.620	8.080	3.191	16.021*	8.416	19.566†	4.892
Pseudo R^2	.	0.148	.	0.167	.	0.277	.	0.285
Observations	.	1032	.	1032	.	1032	.	1032
Log likelihood	.	-115.6	.	-250.5	.	-47.3	.	-109.3
Likelihood ratio χ^2	.	40.1	.	100.5	.	36.2	.	87.2

Sources: See Table 1 for balance sheet data and Table 2 for bank characteristics and macroeconomic data.

Dates for bank mergers and failures are from Beckhart (1929), Holladay (1938), and Noiseux (2002).

Notes: The symbols †, ‡ and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

The binary dependent variables in columns (1) and (3) take the value of 1 in the year of acquisition and year of failure, respectively.

The binary dependent variables in columns (2) and (4) take the value of 1 in the three years prior to acquisition and failure.

Table 5: Timing of bank acquisitions and failures (survival analysis)

	(1)		(2)		(3)		(4)	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Log assets	.077	.101	.047	.054	.799	.532	.233	.182
Loans to assets	.013	.014	.019†	.009	-.236*	.142	-.102†	.043
Securities to risky assets	.005	.014	.016*	.008	-.199	.142	-.081†	.038
Capital to assets	.008	.014	.006	.008	.119	.084	.018	.028
Cash to deposits	.010	.020	-.016	.012	-.117	.107	-.083	.051
Real estate to assets	.039	.107	.091	.093	-1.850†	.837	-.375†	.125
Bad loans to assets	.029	.073	.028	.046	-.940*	.545	-.338†	.160
Log age	.744†	.143	.315†	.081	.352	.506	.132	.179
Head office (BC)	-1.167†	.441	-.196	.273	1.824	4.686	1.154	1.311
Head office (Prairies)	-.074	.235	-.134	.196	2.197	1.915	.473	.497
Head office (Quebec)	-.442†	.215	-.233*	.121	1.101	1.029	.645	.480
Head office (Atlantic)	-.975†	.322	-.250	.169	1.575	1.474	1.485†	.626
Bank Act 1900	.341	.318	.316	.226	1.774	1.334	-.469	.296
Constant	.749	1.966	1.391	1.220	11.277	10.160	9.824†	3.791
Observations	.	1032	.	452	.	1032	.	452
Events	.	30	.	30	.	12	.	12
Log likelihood	.	-32.5	.	-9.9	.	-19.7	.	-9.5
Likelihood ratio χ^2	.	44.7	.	36.2	.	42.3	.	44.6

Sources: See Tables 1, 2, and 4.

Notes: The symbols †, ‡ and * indicate significance at the 1 percent, 5 percent, and 10 percent levels, respectively. Estimated with survival analysis using log-logistic distribution. Observations are all Canadian chartered banks operating on June 30th of each year between 1892 and 1931. Events are failures or acquisitions of banks. The dependent variables in columns (1) and (3) are the time in months from first appearance in the sample until merger and failure, respectively. The dependent variables in columns (2) and (4) are the time in months until merger and failure, respectively, beginning from ten years prior to the event.