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# Double Liability in a Branch Banking System: Historical Evidence from Canada\*

Anna Grodecka<sup>†</sup> and Antonis Kotidis<sup>‡</sup>

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## Abstract

We investigate the effects of the abolition of double liability requirement imposed on bank shareholders in Canada on bank risk-taking and lending behavior. Under the double liability rule, the shareholders of a bank were liable up to twice the amount of their subscribed shares in the case of bankruptcy. With the establishment of the Bank of Canada in 1934, the double liability requirement became less stringent and depended on the pace of the redemption of notes in circulation issued by the individual chartered commercial banks. Using historical balance sheet and accounting data, we show that the abolition of double liability was not accompanied by increased bank risk taking in Canada. Our findings are consistent with the literature that focuses on uniform regulations and nationwide branching as key financial stability elements in Canada.

**Keywords:** Double Liability, Bank Risk-Taking, Leverage, Canadian banks, Financial Stability

**JEL-Classification:** E44, G21, G28, N22

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# 1 Introduction

What is the effect of double liability on bank risk-taking in a branch banking system? Nationwide branching and diversification, along with uniform nationwide regulation and periodical rechartering, were major characteristics of the Canadian banking system that contributed to its stability (Bordo, Redish, and Rockoff, 2015; Calomiris and Haber, 2014). Literature has focused on the impact of double liability on risk-taking behavior of fragmented and badly-diversified U.S. banks. It has been shown that in the U.S., state banks operating under double liability exhibited less risky behavior than the ones operating under single liability, suggesting that double liability was an important mechanism to reduce risk in a unit banking system (Grossman, 2001; Mitchener and Richardson, 2013). In this paper, we focus on the Canadian case, which established a very different banking system. Using balance sheet and accounting data for individual Canadian banks, we perform panel data regressions for the period 1934-1950, when double liability was gradually abolished in Canada and replaced by the single liability. As the abolition of double liability in Canada was linked to the redemption of individual banks' notes in circulation, we use the number of issued notes as a proxy for changing liability. Importantly, we find significant variation in the redemption of notes in circulation among banks and across years, which allows us to use notes as a proxy for the reduction in the liability level. While we cannot claim to have estimated the causal effect of double liability on bank risk-taking, our evidence suggest that within a well-diversified and tightly regulated banking system, the abolition of double liability has an overall small effect on the behavior of banks. Using the number and location of bank branches to determine the geographical diversification of banks, we document a more significant response of poorly-diversified banks than well-diversified banks to the change in regulation. The banks' leverage increases in the period of transformation from double liability to single liability, but it is mostly due to the rising investment in liquid and safe government securities (Neufeld (1972), p. 113-116) and cannot be attributed to increased risk-taking. Focusing on more explicit risk-taking measures, we show that poorly-diversified banks become safer, not riskier, after the abolition of double liability and attribute this to the higher monitoring incentives of creditors of these banks.

Different liability regimes came into spotlight in the wake of the financial crisis 2007-09 that revealed weaknesses of existing regulatory framework in the context of providing incentives for prudent risk-taking. For modern banks, limited liability is a default form of the corporate structure. As such, banks' shareholders liability extends solely to the amount they invested in the bank. However, this was not always the case. Historical examples range from unlimited liability for Scottish and Swedish banks (Grossman and Imai, 2013), through multiple (triple, double) liability in the U.S. and Canada, to single liability. Under the double liability rule present in the Canadian banking system in the 19th and part of the 20th century, in the case of a bank's failure, the shareholders were held responsible for an additional amount not larger than the par value of their shares.<sup>1</sup> There is evidence on successful enforcement of

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<sup>1</sup>Breckenridge (1910), p. 25: *"The shareholders to be respectively liable for the engagements of the company to the extent of twice the amount of their subscribed shares - that is, to the amount of their subscribed shares"*

the double liability (Noiseux, 2002). Thus, being a credible threat, by changing the payoff function faced by bank shareholders and establishing an off-balance sheet buffer for depositors' losses, the double liability likely changed the incentives of both, ameliorating the asymmetric information problem resulting from the principal-agent arrangement present at the bank. Facing higher possible losses, bank shareholders are likely to become more risk-averse under the double liability rule, as compared to single liability arrangement, leading to lower risk-taking. On the other hand, since the double liability offers an additional protection for banks' creditors, under higher levels of contingent liability they are likely to lessen or at least change their monitoring activities and accept higher than otherwise leverage and risky ratios, which could result in a de facto higher risk-taking of banks. Since the theory cannot say much about the strength of these two offsetting effects, the incentive outcome of different liability regulations is best addressed in empirical studies.

Our paper makes several contributions to the literature. First, most evidence on the effects of double liability is based on U.S. data. However, only with the Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 (see McLaughlin, 1995), the U.S. federal government removed interstate branching prohibitions and imposed uniform branching and acquisition rules for the entire country. Thus, the results found in the historical evidence for the U.S. may not be applicable to most modern banks, which operate without branching restrictions. We are the first to study the double liability in a branch banking system, specifically, in Canada. Under branch-banking, branches operate as subsidiaries of the home bank, deposits and assets can be diversified and risk can be spread to various places, making the system more resilient to financial crises. That system led to an oligopoly of few large financial institutions in Canada and it was tightly regulated and governed by the federal government. A comparison between the banking systems of the U.S. and Canada reveals that the former has been known for its frequent and severe financial crises, and the latter one has been a symbol of financial stability.<sup>2</sup> It is thus not a priori clear whether the impact of double liability on financial stability in Canada was as important as in the U.S. However, while comparing our results to the literature on the U.S., one has to note that we focus on the effects of the abolition of the double liability, not its existence.

Second, although the debate about different liability regulations for banks is mostly a historical one, the recent financial crisis spurred renewed interest in different ways of banking regulations. As such, our paper contributes to the debate about the importance of correct bank incentives. For example, Admati and Hellwig (2013) advocate increasing equity requirements for banks and argue that high leverage is not necessary for the financial intermediaries to perform their banking functions. In contrast, Hendrickson (2014) argues that contingent liability is superior to capital requirements, as it shifts the burden of monitoring from regulators to

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*and to an equal amount in addition.*”.

<sup>2</sup> As Calomiris and Haber (2014), p.21, note, “*Since the 1920s, the United States has suffered three systemic banking crises - the widespread bank failures of the Great Depression, the savings and loans crisis of the 1980s, and the subprime crisis of 2007-2009 - while Canada has suffered none.*” On p. 323, we read “*Looking back over all of Canadian banking history and comparing the average loss rates to depositors in the U.S. and Canada, losses to depositors in Canada were 30 percent lower than in the United States.*”

shareholders and aligns the incentives of shareholders with the ones of depositors. Compliance with regulation does not necessarily ensure prudent risk-taking by banks. Poschmann (2014) considers double liability as a policy to incentivize the banks, but admits that reintroducing double liability seems implausible in today’s world (e.g. since the number of shareholders is much higher than hundred years ago, and shareholders often do not have a direct impact on the management of the bank). Admati and Pfleiderer (2009) propose a way to increase the liability of the equity issued by a financial institution without changing the limited-liability nature of publicly-held securities by establishing an “equity liability carrier”. The results of our paper support the claims by Bodenhorn (2015), showing that under a contingent liability regime higher leverage ratios are not necessarily a sign of higher bank risk-taking. Thus, assessing merely the compliance of the banks with the capital requirement rules may give a misleading sense of security.

Third, our paper relates to the literature on the importance of branching and diversification by considering the geographical diversification of banks. The conclusion of Bordo et al. (2015) and Calomiris and Haber (2014) is that branching and allowance for regional diversification were important contributors to the financial stability in Canada. According to some of the considered risk-measure ratios, poorly-diversified banks actually become safer after the abolition of the double liability, while we do not find this effect for the well-diversified banks. The monitoring conducted by depositors had likely stronger effects for smaller, poorly-diversified banks, since they may have been facing a fatter-tailed distribution of returns compared to their well-diversified counterparts and were less likely to absorb the risks as well as the larger banks. This is consistent with the conclusions of Saunders and Wilson (1995) who write (p. 11 ): *“bank creditors have incentives to monitor the erosion of double liability. As erosion occurs, creditors will demand higher premiums as compensation for bearing greater risk.”*

The remainder of the paper is organized as follows. Section 2.1 gives a description of historical details about the banking system in Canada and the double liability requirement. Section 2.2 provides a theoretical fundament for linking the multiple liability requirement to lending and risk-taking behavior of banks and monitoring by depositors, as well as a brief overview of contingent liability in other countries and research findings on it. Section 3 describes the dataset we are using and provides some descriptive statistics on bank leverage, liquidity ratios and deposits. In section 4, we shortly describe the considered risk-taking measures, formulate hypotheses that we are testing with our empirical analysis and discuss the results. Section 5 concludes.

## 2 Double liability in Canada

### 2.1 Historical background

#### *The establishment of double liability in Canada and the institutional setup*

The roots for the modern Canadian banking system evolved gradually starting from the 19th century.<sup>3</sup> At first, the banking system evolved separately in four provinces (Upper and Lower Canada, New Brunswick, Nova Scotia) which formed the Dominion of Canada in 1867,<sup>4</sup> and an unlimited liability of shareholders was common. Marquis and Smith (1937) report that the first mention of double liability on Canadian territories can be found in 1830, but the first general Canadian banking act that formally prescribed this rule for all chartered banks was passed in 1870. The first plans to introduce the double liability were opposed, as they were seen as a measure to intimidate capital and limit prosperity. However, the colonial British government enforced the new law.

Double liability was an inherent part of the Canadian banking system almost right from its creation and there is evidence that it was successfully enforced. Noiseux (2002) provides information on that, examining 26 Canadian bank failures in the period 1868-1923. She divides the period into three subperiods that differed in the degree of enforceability: in the period 1868-1881 eight banks failed, and double liability was collected in two cases; in the period 1883-1899 there were nine bank failures and double liability was enforced in four cases; and in the period 1905-1923, there were nine bank failures and double liability was collected in eight cases. Over the whole sample period, due to the double liability an average of 59% of the paid-up capital was collected (compared to 49% in the U.S. case), and individual shareholders' contributions ranged from 30 to 100 percent. Thus, we can observe an increased enforceability of the double liability requirement over time. From 1923 to 1985 there were no bank failures in Canada, so nothing can be said about the strictness of the enforcement of double liability in that period, but given the increased level of double liability collections over time, we assume that for banks operating in the period 1934-1950, which is of most interest to us, the double liability rule could be an important incentive mechanism for higher risk-taking behavior.<sup>5</sup>

Chartered banks were mostly introduced in Canada to resolve the problem of the lack of currency on Canadian territories and their right to issue notes distinguished them from other financial intermediaries at that time (Neufeld, 1972).<sup>6</sup> The bank charters were prolonged every

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<sup>3</sup>Breckenridge (1910) reports about the existence of Canada Banking Company as early as in 1792, but only few records from that time can be found. Only 25 years later a new project of bank issue has been launched in Montreal, Lower Canada.

<sup>4</sup>As a Dominion, Canada was a semi-independent country eligible for the self-governance, with some exceptions (as changes in the constitution, or signing own treaties). The Statute of Westminster, 1931, extended the Dominion's rights to the independent external affairs. See Encyclopaedia Britannica Online (2015).

<sup>5</sup>There is a risk that double liability by shareholders could be avoided by insiders transferring their shares before the actual failure. In Canada, steps were taken to avoid such an occurrence. Walker (1894), p. 230 writes: "No transfers within sixty days before failure avoid double liability of the transferor unless the transferee is able to pay".

<sup>6</sup>The chartered banks could issue notes of \$5 and multiples to the amount of the paid-up capital. Additionally, in the period of the movement of the crops, an "excess" circulation of up to 15 percent of the equity was possible, but it was linked to an interest payment of 5 percent on the excess. From 1850 on (due to the Free Banking

ten years (since 1992, every five years) and this constant rechartering provided on the one hand regulatory discipline over banks, but on the other allowed banks to lobby regulators and update their business model along with changing circumstances, so as not to be at a competitive disadvantage compared to other intermediaries (Calomiris and Haber, 2014). The banks were mostly lending on short-term and were not allowed to issue mortgages until 1967, as it was believed to lock up their funds and could lead to maturity mismatch (Neufeld, 1972).

It is important to note that deposit insurance was introduced in Canada in 1967, so in the whole period of double liability in Canada, it was not yet present. However, some researchers claim that the implicit government guarantee was in place and played a substantial role in guaranteeing the financial stability in Canada (Kryzanowski and Roberts, 1993). Neufeld (1972) points to the Finance Act of 1913 that gave chartered banks access to emergency cash, and since 1935, to the Bank of Canada as the lender of last resort. Carr, Mathewson, and Quigley (1995) attribute the stability of the Canadian banking system to the merger movement, which mainly arose due to market forces rather than government requirement. This is supported by Calomiris and Haber (2014) who note that Bank of Montreal, which served as a fiscal agent of the government, often served as a coordinator of mergers. However, it did allow the small banks to fail and only when a bank was of systemic importance, such a coordination took place. Calomiris and Haber (2014), p. 305: *“This was an important attribute of the system: unless depositors knew that they would suffer the losses, they would have no incentive to monitor the behavior of bankers.”*<sup>7</sup> Curtiss (1948) notes that it is a common feature of branch banking systems, like the one established in Canada, to concentrate resources in the hands of a few banks. The number of banks operating in the Confederation decreased gradually from 44 in 1880 to 10 in 1934, both due to mergers and failures.

#### *The founding of the Bank of Canada and its consequences for the double liability*

The Canadian banking system was operating efficiently without the existence of a central bank, but the economic crisis in Canada and the worldwide economic slump of the 1930s made Prime Minister R.B. Bennett think about establishing a central bank. He set up a royal commission in 1933 which was supposed to consider arguments for and against a central bank. The commission advised creating such an institution and the Bank of Canada Act was passed on July 1934. The privately-owned bank opened its doors on March 11th 1935 and was nationalized in 1938. Bordo and Redish (1987) argue that the emergence of the Bank of Canada was a response to political rather than economic pressures: International organizations urged countries that did not yet have a central bank to establish one, as this would facilitate international monetary cooperation. In the absence of a Canadian central bank, international balances between Canada and London were settled in New York, where also the value of the

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Act), only chartered banks had right to issue notes. However, the notes were not legal tender in Canada.

<sup>7</sup>Interestingly, in the initial years, even auditing of banks was perceived as detrimental in Canada. Walker (1894), p. 247 notes: *“When the audit system was proposed, we resisted because we felt that it pretended to protect the shareholders and creditors, but did not really do so, and if the audit did not really protect it seemed better that shareholders and creditors should not be lulled by imaginary safeguards, but be kept alert by the constant exercise of their own judgment.”*

Canadian dollar was determined. As Calomiris and Haber (2014), p. 312, note *“As an economic matter, the creation of the Bank of Canada had little effect on the commercial banking system: there simply wasn’t much broken that needed fixing.”*

Nonetheless, the creation of the Bank of Canada had important consequences for the operations of commercial banks. The Bank of Canada was designed to serve the public interest and to have the sole right of issuing Canadian banknotes. The ten chartered banks existing in 1934 had until then issued their own notes into circulation, but as the Bank of Canada was to become the sole issuer of banknotes in the country, the amendment to the Bank Act of 1934 restricted their note-issuing privileges. Dixon (1935) writes (p.76): *“A bank’s maximum issue must not exceed the amount of its unimpaired paid-up capital; and on the first day of January in each year for a period of five years commencing in 1936, the maximum shall be reduced by 5 per cent. On the first day of January in each year for a period of five years commencing in 1941, the maximum shall be reduced by 10 per cent and thereafter, until Parliament further enacts, shall not exceed 25 per cent of the unimpaired capital.”* Along with the redemption of their own notes, banks could decrease the double liability by the same percentage (Dixon, 1935, p. 76-77: *“Along with the restriction of the note-issuing privileges of the banks, there is provided a corresponding reduction in the super-added liability of shareholders. In the event of insolvency this liability of a shareholder, in addition to any amount unpaid upon the shares held, will not bear a greater proportion to the par value of the shares held, than the proportion of the amount of notes which the bank is authorized to issue bears to the paid-up capital of the bank”*. As such, banks that withdrew their notes in circulation by e.g. 5% could reduce their shareholders’ double liability by the same percent.

The law imposed minimum redemption rates on chartered banks, but nothing prevented banks from reducing their note issuance and thus, double liability, at a rate above the prescribed lower bound. In fact, tracing changes in the notes in circulation for each bank and each considered year, we notice considerable heterogeneity across banks and time, which allows us to use the change in notes in circulation as a proxy for changing double liability level. Formally the right of commercial banks to issue their own notes was brought to an end by the amendment to the Bank Act in 1944 that specified that all chartered banks should redeem their notes in circulation until January 1st, 1950. Additionally, the Bank Act of 1934 established a 5 percent reserve requirement for banks (to be held as a deposit with the Bank of Canada or notes of the Bank of Canada) which was calculated with respect to the deposit liabilities within Canada. This requirement was not binding for most of the banks, as they were used to keep a higher proportion of deposits in the form of cash reserves (Neufeld, 1964). Given the changing nature of contingent liability in Canada in years 1934-1950, we focus our analysis on that period, investigating whether the declining level of contingent liability was accompanied by changing risk-taking by bankers. The theoretical explanation for the incentive changing role of contingent liability is provided in the following section 2.2.

## 2.2 The incentivizing role of contingent liability

### *The shareholders' perspective*

Esty (1998) shows that the form of liability faced by a banker has an impact on risk-taking behavior due to the changed payoff function from the investment in bank equity. Equity can be interpreted as a call option on a bank's assets. When contingent liability is in place, the equity value is equal to the value of being long a call option with the strike price equal to the face value of deposits ( $D$ ) minus the maximum liability assessment ( $L$ ) and being short a bond with the value  $L$ . Thus, following Esty (1998) we define the Equity Value ( $EV$ ) as follows:

$$EV = \max[BV - (D - L), 0] - L, \quad (1)$$

where  $BV$  denotes the Bank Value. The payoff functions for equity under different liability rules are depicted in Figure 1. For the purpose of figure, we assume face value of deposits  $D=90$  and par value of equity equal 10.

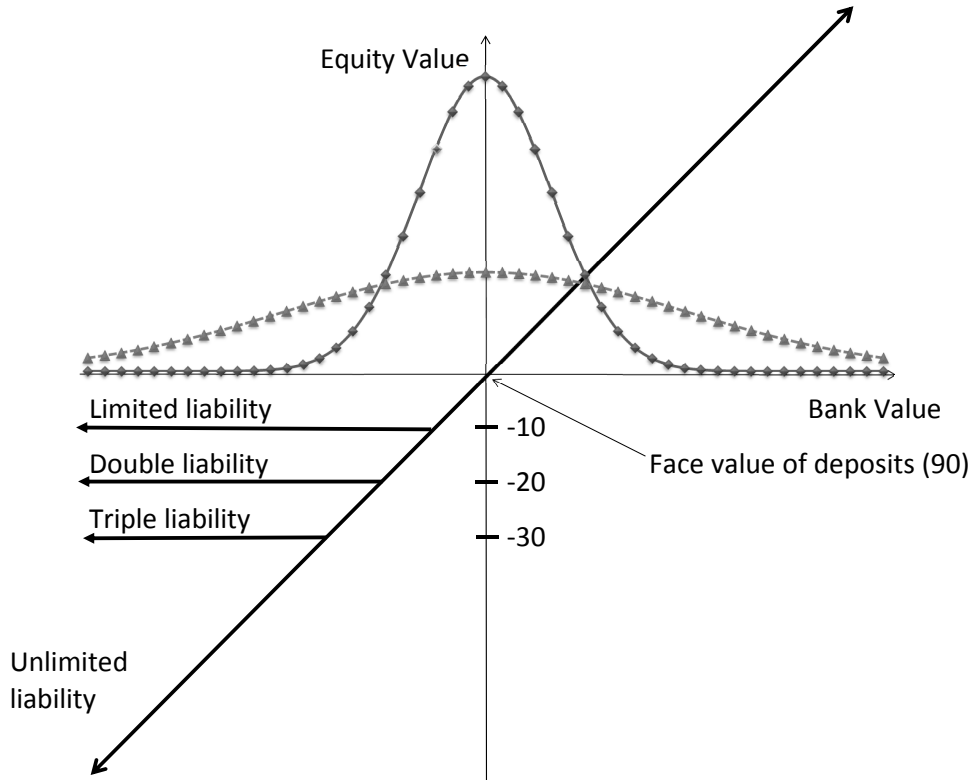


Figure 1: Equity payoffs under different liability regimes

A number of facts emerge from equation 1 and Figure 1. If the bank value is large enough, then irrespective of the liability requirement, the upward equity value is unlimited; it increases with the increase in the bank value. If the bank value is lower than the strike price  $D - L$ , then the higher the contingent liability, the larger the possible negative returns on equity. Comparing the double liability rule with limited liability, we note that in this case the equity value function of the double liability lies below the limited liability function, which means that the former is worth less (-20 compared to -10). In the extreme case of the unlimited liability, the negative returns are unlimited. Thus, a change in contingent liability may affect risk-taking behavior of shareholders due to a change in equity payoffs.

Following Grossman and Imai (2013), if we assume a normal distribution of bank returns with mean zero, we can plot hypothetical probability distributions of bank's returns along with the equity value in Figure 1. Banks operating under limited liability can increase the return on the equity by exploring the tails of the distribution, engaging thus in riskier projects. Holding all else constant, banks operating under the double liability provision would engage relatively less in the risky projects, as that would increase their possible negative payoff from the equity. The relationship between the degree of contingent liability and risk-taking is also dependent on the diversification possibilities of banks. Under the assumption of normally distributed returns, if a bank is well-diversified in the first place, Grubel (1968) and Levy and Sarnat (1970) show that diversification results in lower standard deviation of returns and lower portfolio riskiness, such that the outcomes far away from the mean of the distribution will be much less probable.<sup>8</sup> If a bank has a badly-diversified asset portfolio, it may face a probability distribution of returns with high standard deviation, relatively fat tails, and skewness. This, along with the discussion about the importance of branching and diversification for the stability of the Canadian financial system, brings us to the consideration of relatively well- and poorly-diversified banks in Canada, as the theory suggests that the results may be different depending on the degree of banks' diversification.

### *The creditors' perspective*

As mentioned in the introduction, contingent liability may have impact not only on risk-taking incentives of shareholders, but also on the monitoring incentives of creditors, which are motivated by risk bearing (Carr, Mathewson, and Quigley, 1995). Moreover, Wilson and Kane (1996), p. 5., note that we should not treat double liability as an unilateral concession to depositors that reduces shareholders wealth, since stockholders "*anticipate a quid pro quo from creditors for so enhancing the bank's credit.*" As Bodenhorn (2015) explains, contingent liability, as opposed to unlimited liability, reduces substantially the need for the shareholders to monitor other shareholders (given the cap on each owner's exposure), but it does so less for the creditors. While unlimited liability is a preferable arrangement when shareholders are better able to monitor the bank, limited liability is more efficient when depositors have superior monitoring skills. Double liability is an in-between arrangement and the assessment of the risk-sharing is much more complex under such a rule. Referring to the U.S., Bodenhorn (2015), p. 7 notes that "*Double liability (...) offers an off-balance sheet "trust fund" for creditors, but one less easily valued than an explicit on-balance sheet capital account. Nineteenth-century*

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<sup>8</sup>Numerous empirical studies contradict the assumption of normally distributed returns (e.g. Fama, 1965), showing at the same time that higher order moments are important to portfolio decisions (Arditti, 1967, Scott and Horvath, 1980). Literature provides contradictory results on the effect of diversification on skewness and kurtosis. For example, Aggrawal, Rao, and Hiraki (1989) show that kurtosis decreases through diversification for Japanese stocks. On the other hand, when examining diversification along with different investment horizons, Tang (1994) finds that neither skewness, nor kurtosis can be reduced through diversification with the effect varying across different holding periods. A similar result is obtained by Tang and Choi (1998), who consider a larger sample of eleven stock market indexes.



*legislators and regulators likely recognized the ability to contract around the double liability rule and supplemented double liability with minimum capital-requirements, minimum reserve ratios, maximum debt-to-capital ratios, and maximum asset-capital ratios, among others.”*

Grossman (2001) discusses that the change of the liability protection enjoyed by shareholders is one way to limit bank risk taking. Another could be the elimination of deposit insurance. The main difference between the two solutions is that while extended liability demands higher monitoring by depositors and shareholders, deposit insurance shifts the monitoring burden to the regulator. Although it may be effective in avoiding bank runs (Diamond and Dybvig, 1983), it may also create moral hazard problems. Calomiris (1990) notes that insurance removes the discipline of the market. Analogous to the introduction of deposit insurance, the introduction of double liability for bank shareholders changes the monitoring incentives of creditors. As such, we may expect that the observed change in risk measures due to the abolition of double liability in Canada is a consequence of changed behavior of both shareholders (lower personal risk exposure, thus potentially higher risk taking) and creditors (higher loss exposure, thus increased monitoring and potentially lower risk-taking by banks), and the net effect of that change can be analyzed by looking at the data.

#### *Empirical evidence from other countries*

Most empirical evidence is based on U.S. data. The historical fragmentation of the U.S. banking system allows for a straightforward analysis of the impact of double liability on bank risk-taking. While the laws imposed on Canadian banks were relatively uniform, in the United States the liability requirements on bank shareholders differed across states, ranging from unlimited liability to limited liability. With the passing of the first act establishing a national system of banks in 1864, the double-liability requirement was imposed on national banks. The legislation resulted in the simultaneous existence of states with different laws that facilitates the examination of the effects of differing liability regimes on risk taking. The existence of a parallel national banking system corrects for cross-state differences that complicate the problem and might have accounted for differences in risk taking.

The empirical evidence provides support for changed shareholders’ and depositors’ incentives and is somehow mixed. Analyzing bank failure rates in single and multiple liability states, Grossman (2001) concludes that bank failures were higher in single-liability states. The regression analysis with capital to assets and liquid assets to deposits ratios as dependent variables provides modest support for the claim that banks operating in multiple-liability states had higher ratios of capital to assets and liquid assets to deposits. Mitchener and Richardson (2013), using a new panel data set, confirm the result that in the U.S., double liability reduced risk taking, as it resulted in lower leverage and fewer lending. Esty (1998) finds that for banks in states with stricter liability rules, the equity and asset volatilities are lower and the proportion of risky assets (bonds, stocks, owned real estate) is lower. This evidence gives support to the claims that double liability changes shareholders’ incentives and reduces their risk taking.

However, there are also papers whose evidence can be best explained by looking at the existence of double liability from creditors' perspective. Macey and Miller (1992), p.35, document for the U.S. that *"Banks with double liability (...) appear to have been able to operate with lower capital ratios than banks without double liability. (...) One possible inference from these data is that bank creditors relied on the assessment remedy for assurances that the bank's debt would be repaid, and accordingly demanded less by way of equity capitalization as their cushion against insolvency. Put another way, the potential liability of bank shareholders served as supplemental off-balance sheet capital that was not reflected in banks' capital ratios."* Similarly, Bodenhorn (2015) finds for U.S. banks that after the introduction of double liability bankers actually increased their leverage, which he attributes to the fact that bank creditors were content with it due to the additional, off-balance sheet guarantee provided by the double liability provision. Although the results on different risk measures for U.S. are somehow mixed, all authors conclude that double liability was an important factor stabilizing the financial system in the U.S.

An alternative mechanism for imposing multiple liability upon shareholders is uncalled capital, which was common in Britain during the late 19th and early 20th centuries. Bank equity was required to be paid-in by shareholders at the time of the initial offering. If only a part of these shares were paid-in, the rest (unpaid capital) was subject to multiple liability and could be called at the bankers' discretion. As Grossman and Imai (2013), p.135, mention, the difference with respect to double liability was that double liability came *"into play only if the institution in question is being wound up. (...) On the other hand, those owning shares with unpaid capital are obligated to meet capital calls under all circumstances, whether or not the firm is in liquidation"*. Exploiting the varying levels of extended liability of British banks before the First World War, Grossman and Imai (2013) conclude that stricter liability rules were associated with less risky behavior of banks.<sup>9</sup>

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<sup>9</sup>Apart from the effect on risk-taking behavior, scholars discuss the impact of different liability regimes on shares trading. For example, Hickson and Turner (2003) test Walter Bagehot's hypothesis that shareholders in an unlimited liability bank would find profitable to extract rents by transferring shares ownership to poor individuals, turning the bank *de facto* limited. This happens because the bid price for unlimited liability bank is a function of a buyer's wealth and the impecunious, having not much to lose, will bid the highest. In 19th century Ireland, Hickson and Turner (2003) find no evidence of such transfers, even in times of increased probability of bank distress. Acheson and Turner (2008), contrary to contemporary beliefs that failure of the City of Glasgow Bank resulted in shares trading to low-wealth individuals, find little evidence supporting this view. The impact of limited liability on ownership and control of shares in British banking after 1878 is tested in Acheson and Turner (2006) on an example of the Irish Ulster Bank that adopted the limited liability in 1883. It is shown that the conversion from unlimited to limited liability was followed by an increase in ownership diffusion, with a broader spectrum of individuals, including the less wealthy ones, becoming the shareholders.

## 3 Data

### 3.1 Balance sheet data for Canadian banks

Our main data source is the historical Canada Year Book, which provides balance sheet and accounting data for chartered banks (individual banks' balance sheets are available from 1901 on, before that only the aggregate data is presented). The yearbooks are available in a scanned version on the website of the Statistics Canada and provide details on the main components of assets and liabilities of chartered banks, number of their branches, as well as profits and dividend rate (that was regulated for most of the period).

It is important to note that double liability was imposed on shareholders with respect to the par value of shares held by them, which is synonymous with the paid-up capital and does not include reserves, etc. The available data for individual Canadian chartered banks for the period 1934-1950 provides us only with the total liabilities to shareholders (equity), encompassing both the paid-up capital and the reserve fund. However, a comparison of individual banks' data with the data for the aggregate makes clear that in the given period, the only change in the paid-up capital occurred between the years 1934 and 1935. For the years 1934 and 1935, the statistical yearbook provides the distinction between different categories of liabilities to shareholders also for individual banks. Combining this information, we are able to conclude that the only bank that changed its paid-up capital in the period 1934-35 was the Barclays Bank of Canada who increased its capital from 500,000 to 1,500,000 between 1934 and 1935. After 1935, there were no changes in the paid-up capital of any of the banks, so we are able to create a series for paid-up capital and the reserve fund for each bank.

Despite their availability, the yearbooks are not a perfect source of data, as over time, the way of presenting balance sheet data changed several times. In the early sample years, the Canada Year Book provided information on individual chartered banks at the end of the year, while for later years, balance sheets calculated as an average over 12 months are available for a given year and preceding years. Given the availability of data, we use the 12-month averages for each year to be consistent over the considered time period.

The Bank Act of 1934 directly linked the change in issued notes by a given bank to the super-added liability of shareholders. If double liability was a regulation that had impact on the risk-taking and lending behavior of banks, we should see an impact of the reduction in double liability on the behavior of banks and the size of their balance sheets. When we examine the raw data, a noticeable change can be noted for the periods 1867-1933 and 1934-1950. Figure 2 presents the number of issued notes for all chartered Canadian banks (left-hand scale), plotted against leverage, defined either as a ratio of assets to the paid-up capital or as a ratio of loans to the paid-up capital (right-hand scale). The upper panel of the graph presents the data from 1867 to 1933 and the lower panel, the data from 1934 until the complete abolition of the double-liability rule in 1950. We treat the paid-up capital rather than equity as our reference variable, as double liability was imposed on shareholders with respect to the par value of shares held by them, which is the paid-up capital without reserves. In the first period, we see an

overall positive relationship between the number of notes in circulation and the leverage, while in the second period this turns negative (much stronger for total assets than loans only). From the graphs, it can be seen that irrespective of whether the double liability was in place or not (as mirrored by notes in circulation), leverage follows an upward trend throughout the entire period. One could argue that this may have turned the Canadian banking system more vulnerable to shocks; however, it is known that the Canadian banking system was much more stable than the U.S., despite the overall higher leverage.

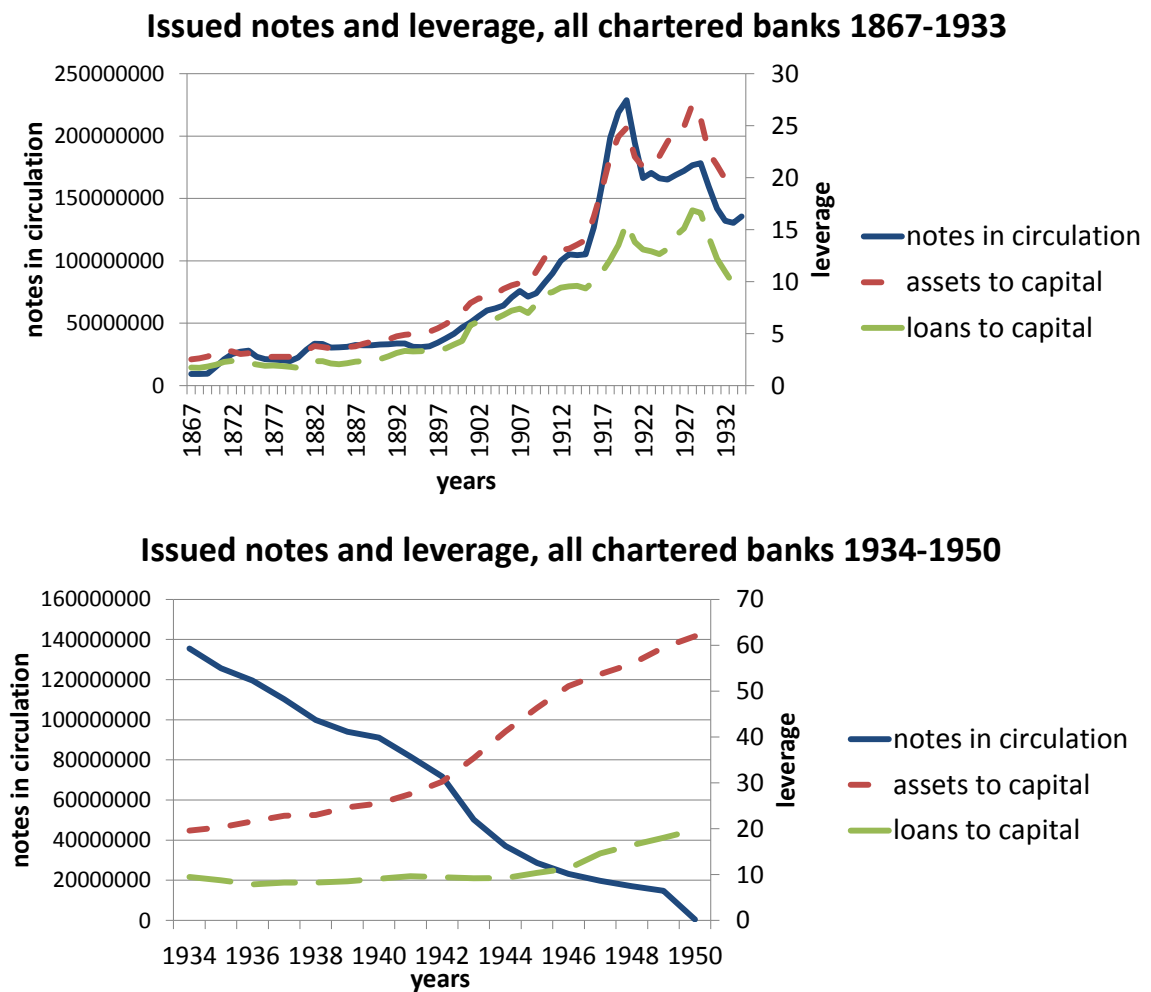


Figure 2: Issued notes and leverage 1867-1950

As leverage exhibited an upward trend even before the abolition of the double liability rule, it is important to consider whether the change in notes in circulation had any significant impact on the pace of this development. In order to do so, it may be helpful to consider other financial intermediaries acting in Canada at this time that performed similar functions as banks. In the middle of the 19th century, loan and trust companies started to evolve in Canada, first in form of building societies that focused mostly on collateralized lending through real estate.<sup>10</sup> Beginning in 1859, these companies had the right to borrow a limited amount of money and from 1874 on, they could receive money on deposit and issue debentures. Loan companies had

<sup>10</sup>Building society is a mutual organization owned by its members and providing financial services to them.

the role of a typical financial intermediary - they could extend loans and collect deposits, but their activities were not regulated by the double liability provision. Thus, they can be seen as competitors to banks' activities. On the other hand, trust companies played a different role in the financial sector: they acted mainly as agents of estates, guardians of minor and incapable persons, or trustees in bankruptcy. Their lending and deposit facilities were restricted by law.<sup>11</sup> Thus, having access to the aggregate data on loan and trust companies, we choose to include the data on former ones as control variables in our regressions. We have access to aggregate data on loan companies from 1914 on (before that date, the data was collected for loan companies and building societies as aggregate). The Figure 3 presents the leverage defined over equity (upper panel) and capital (lower panel) for banks and loan companies over the period of 50 years starting in 1914. It is important to note that, from 1954 on the data represents numbers on 31st December of each year as opposed to an annual average as before, due to a change in the reporting, so the numbers after 1954 are not directly comparable with the values for earlier years. Most importantly, the graph marks with a green dashed vertical line two crucial dates for our analysis: 1934, when the law gradually abolishing double liability for Canadian banks was passed, and 1950, when the transition period was over.

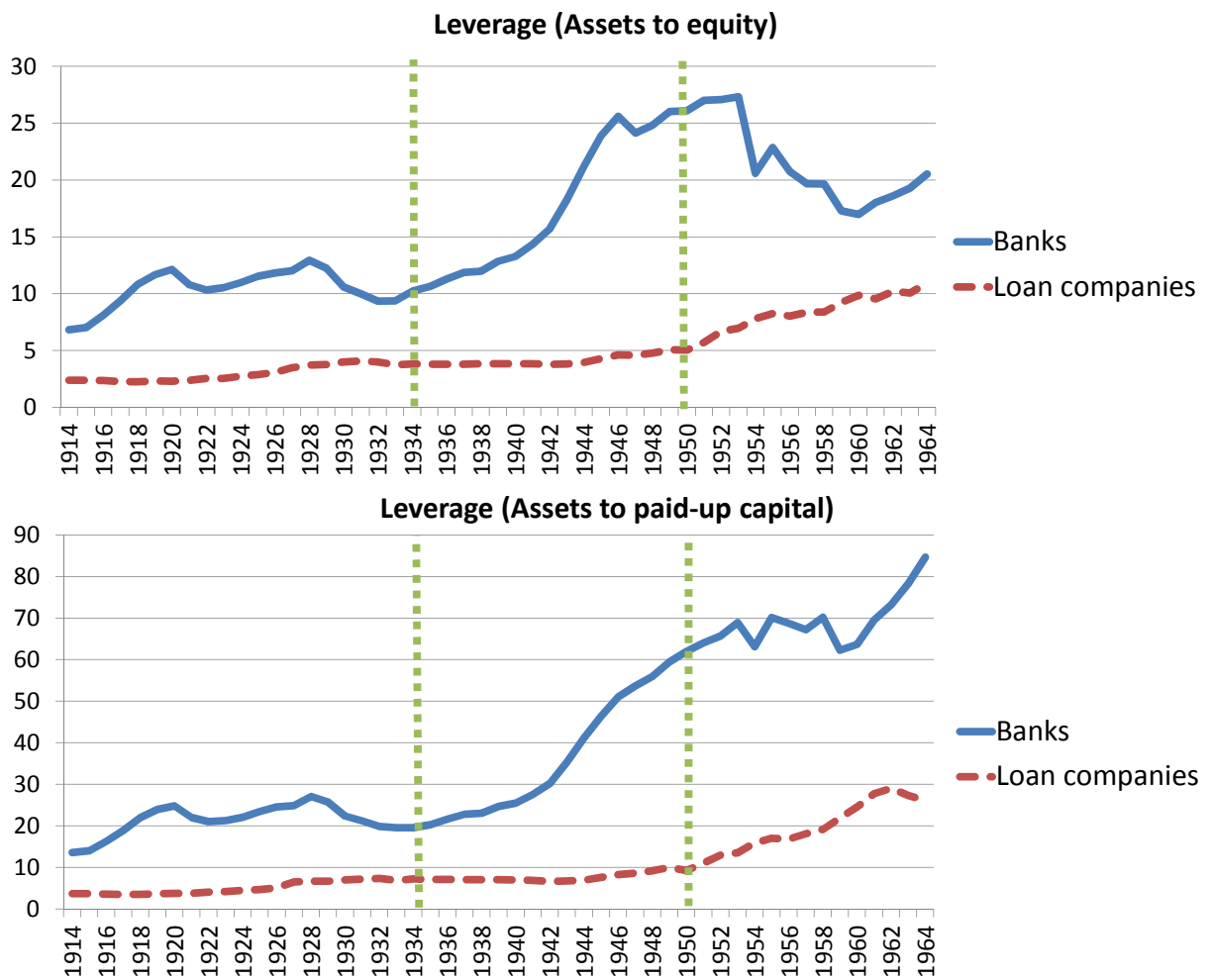


Figure 3: Leverage for banks vs loan companies 1914-1964

<sup>11</sup>Neufeld (1972), p. 93, classifies both loan companies and trust companies as near competitors of banks.

We may note that before the Bank Act of 1934, leverage, although different in levels, was increasing hand in hand for banks and loan companies. After 1935, for both types of leverage, we may notice a substantial increase of leverage for banks, so that the difference in leverage between banks and loan companies rises notably. This divergence seems to come to an end after 1950, when the leverage by banks stops increasing, while the leverage for loan companies continues to do so. In the case of other ratios, such as loans to assets and the cash ratio presented in Figure 4, no visible divergence can be seen. The evidence for leverage for banks and loan companies may suggest that indeed, the gradual abolition of the double liability for banks increased their risk-taking behavior, if we treat leverage as a good proxy of risk-taking. In order to test this hypothesis, we conduct panel data analysis, presented in Section 4.

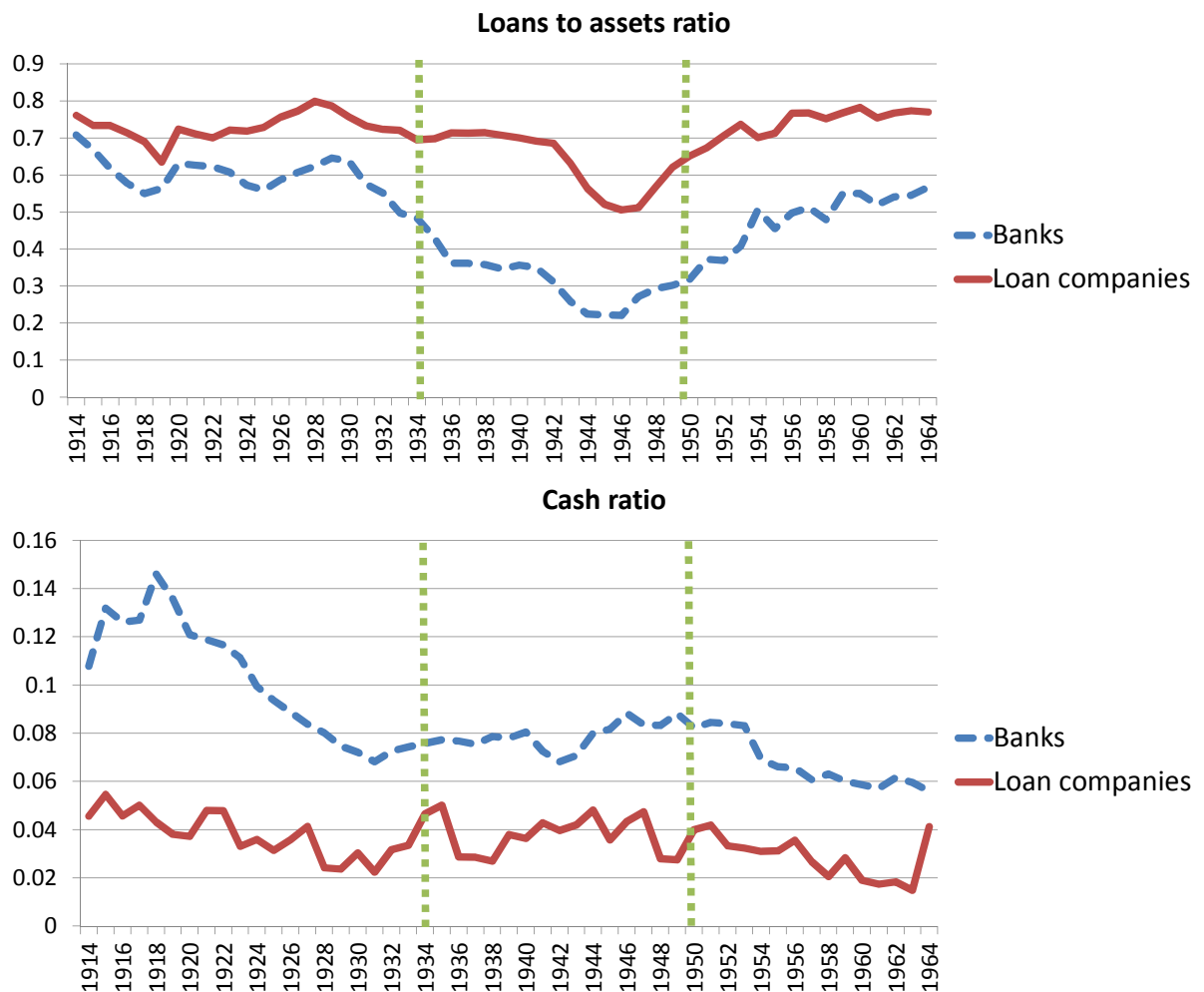


Figure 4: Leverage for banks vs loan companies 1914-1964

Since the abolition of double liability could have changed the incentives of depositors as well, we investigate whether any substantial change in deposits compared with deposits of other financial intermediaries can be observed. In Figure 5 we plot the deposits of chartered banks (left axis) against the deposits of loan companies (right axis) and savings banks (right axis). There is no evidence on the outflow of deposits put at chartered banks due to the reduction of double liability in favor of the deposits flowing into loan companies or savings banks (no evidence was also found for the link between the level of double liability and deposit

flows at individual banks' level).

One possible implication of declining contingent liability level could be also a higher interest rate on deposits, demanded by creditors as a compensation for the higher risk. Investigating the aggregate data on bank accounting statistics, we may deduce the interest rates paid on deposits by chartered banks in the period of interest. While the interest rates on loans of Canadian banks were subject to a 6 or 7% ceiling in period 1934-50, there was no ceiling on interest rate demanded on deposits. However, the interest rates paid on deposits paid into chartered banks followed closely interest on government securities. In our computation, we calculate the interest rate on deposits under assumption that no interest rate was paid on demand deposits (indeed, since 1936, no interest was paid on current accounts, see Nixon, Bryden, and Hackett, 1937). Thus, we obtain the interest rate by dividing the interest paid on deposits by the sum of notice deposits in Canadian chartered banks. We compare this interest rate with the 3-month treasury bill rate that is available for the period 1934-50 and plot both rates in Figure 6.

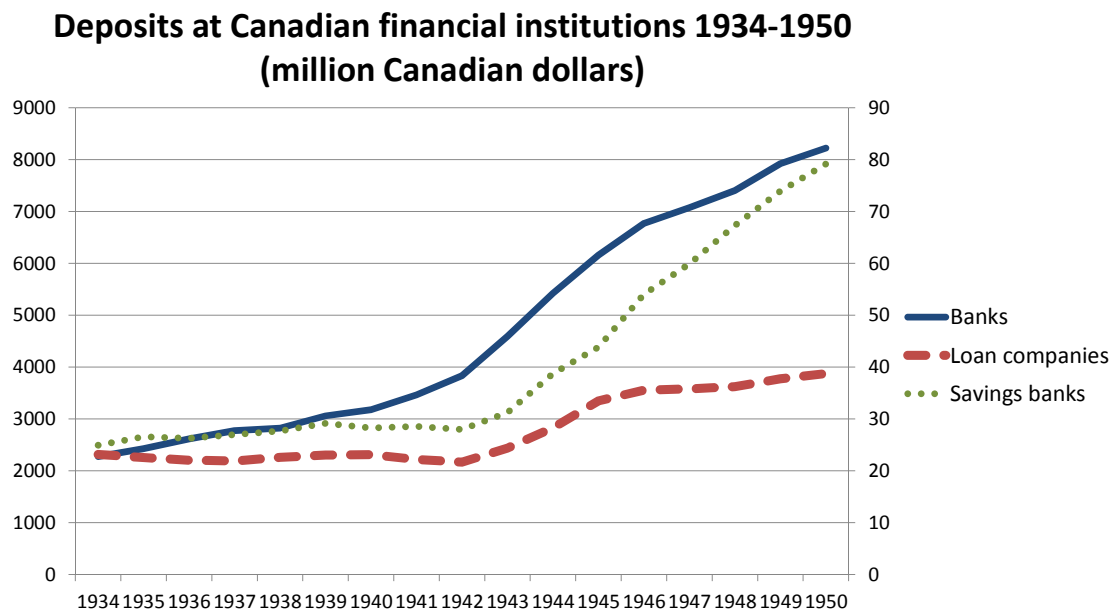


Figure 5: Deposits at Canadian financial institutions 1934-1950

The initial decline in the interest rates at the beginning of the period 1934-50 can be attributed to “governmental policies of an emergency nature” (Nixon et al. (1937), p. 421). In the wake of the Great Depression, the Canadian government tried to create easy money, reducing the cost of credit to households and companies, but also the cost of government financing. As Nixon et al. (1937) write, p. 434, “The relatively low level of rates now current and the downward trend of rates in recent years have been due to the co-operative efforts of governments and mortgage holders to relieve distressed debtors (...) and in part to the influence of easy money conditions.” The decline in the deposit rates was initiated by the government who had the right to lower the deposit rate on Post Office Savings Bank Account (Ascah, 1999). W.C. Clark, the deputy minister of finance, explicitly expressed the expectations towards banks:

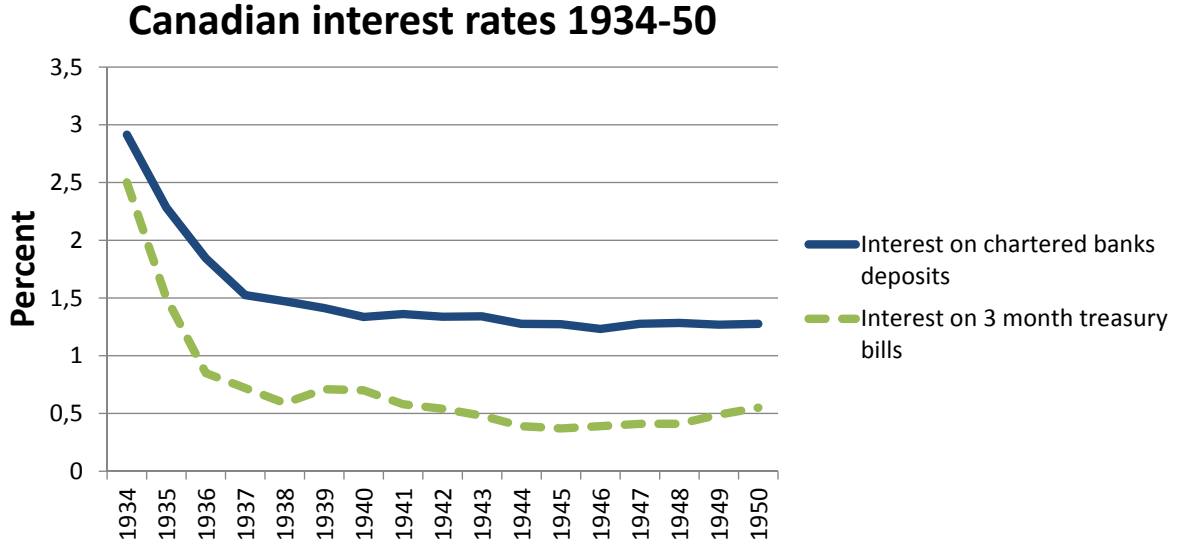


Figure 6: Deposit and treasury bill rates in Canada 1934-50

*“Absolute necessity for gradually effecting a lowering of interest rates in this country. (...) We believe it to be very much in the interest of the banks themselves to co-operate wholeheartedly with the Government in the attempt to effect a reduction in the interest burden by normal economic processes.”*(Ascah, 1999, p. 47). A decline in the interest rates paid by banks on deposits was thus “arranged”, and explicit pressure was exerted on other financial intermediaries collecting deposits. As such, the analysis of the deposit flows and the interest paid on deposits is not very informative for the purpose of establishing any relationship between depositor demands and the level of contingent liability.

### 3.2 Bank branching on the provincial level

The possibility of branching is an inherent feature of the Canadian banking system. We have access to the data on number of branches of each chartered Canadian bank in the years 1934-50,<sup>12</sup> with detailed information on the provinces and countries (for branches abroad) where the branches were located. The Royal Bank of Canada corresponds to the largest bank with respect to assets and the number of branches, while the Barclays Bank of Canada is the smallest bank operating only in 2-4 domestic branches over the considered time period. All remaining chartered banks had at least 100 branches, with the maximum number of branches reaching 754. We analyze the regional diversification of each Canadian bank, taking into account the population and net production data for each province, as well as their foreign activities (a description is given in Appendix A).

We use the aggregate statistics on the number of bank branches in Canada to determine which banks were above and below the overall average for a given year in a given province. In that way, we determine which banks were relatively well geographically diversified, relative to the other banks. In the absence of detailed data on the size and asset exposure of branches, we assume that each bank branch has the same dimension. Taking all banks together and compar-

<sup>12</sup>Data is not available for the year 1942; we construct the number of branches for that year using linear interpolation.



Variable Year	(Well-diversified banks)		(Poorly-diversified banks)	
	1934	1950	1934	1950
Number of branches	544.5	534.25	145.22	159
Number of provinces with branches	9.5	10.75	5	6
Share of notes in liabilities (%)	4.48	0	5.7	0
Dividend rate	9	11	9	10
Paid-in capital (mil)	28.25	28.25	5.25	5.42
Balance sheet size(mil)	571	1762	92	340
Profits (*1000)	3442	4704	912	923

Table 1: Summary statistics for well- and poorly-diversified banks (average for the subgroups)

ing the number of branches with the provincial net production, it is visible that some provinces had an underrepresentation of bank branches (e.g. Ontario, Quebec, British Columbia), and some were overrepresented (e.g. Manitoba, Saskatchewan, New Brunswick). Thus, we treat the average proportion of bank branches for all banks as our benchmark for determining well- and badly-diversified banks. Almost each bank was underrepresented in at least one province, however from the dataset, a pretty clear picture emerges: Bank of Montreal, Bank of Nova Scotia, Canadian Bank of Commerce and the Royal Bank of Canada were fairly well-diversified in comparison to the rest of the banks. Among these banks, the Bank of Nova Scotia is a relatively small one, but is fairly well diversified in Canada and abroad. The division between the well- and badly-diversified banks becomes striking once we demonstrate the regional differences on maps (only for domestic branches). Figure 10 in Appendix B presents the average number of branches in each provinces for all banks in years 1934, 1943 and 1950. It is evident that during the 2nd World War the number of bank branches in Canada decreased, but as the map for 1950 shows, the branching regained momentum once the war ended. The same pattern can be observed for individual banks. We present the branches for individual banks on the provincial level in 1934 (Figure 11), 1943 (Figure 12) and 1950 (Figure 13) in Appendix C.<sup>13</sup> A clear division between well-diversified and badly-diversified banks emerges. The Bank of Nova Scotia is somehow a borderline case, but we include it in the group of well-diversified banks because it had the second-largest number of Canadian bank branches abroad.

Well- and poorly-diversified banks followed similar trends in the period 1934-50. Looking at Figure 7, we may note that poorly-diversified banks operated under lower leverage than their well-diversified counterparts. When we look at the decomposition of assets, loans were experiencing a downward trend as a proportion of assets for both groups of banks (see Figure 4), and securities an upward trend (see Figure 8). The cash ratio, presented in Figure 8 was relatively stable for well-diversified banks, but it increased substantially for poorly-diversified banks and at the end of the considered period, was higher than the respective ratio for well-diversified banks. Table 1 presents basic summary statistics for well- and badly-diversified banks before the change in regulation (1934) and after the transition process to double liability was over (1950).

Apart from the notable difference in the behavior of the cash ratio in the group of poorly-

<sup>13</sup>Large versions of the same maps are available on request.

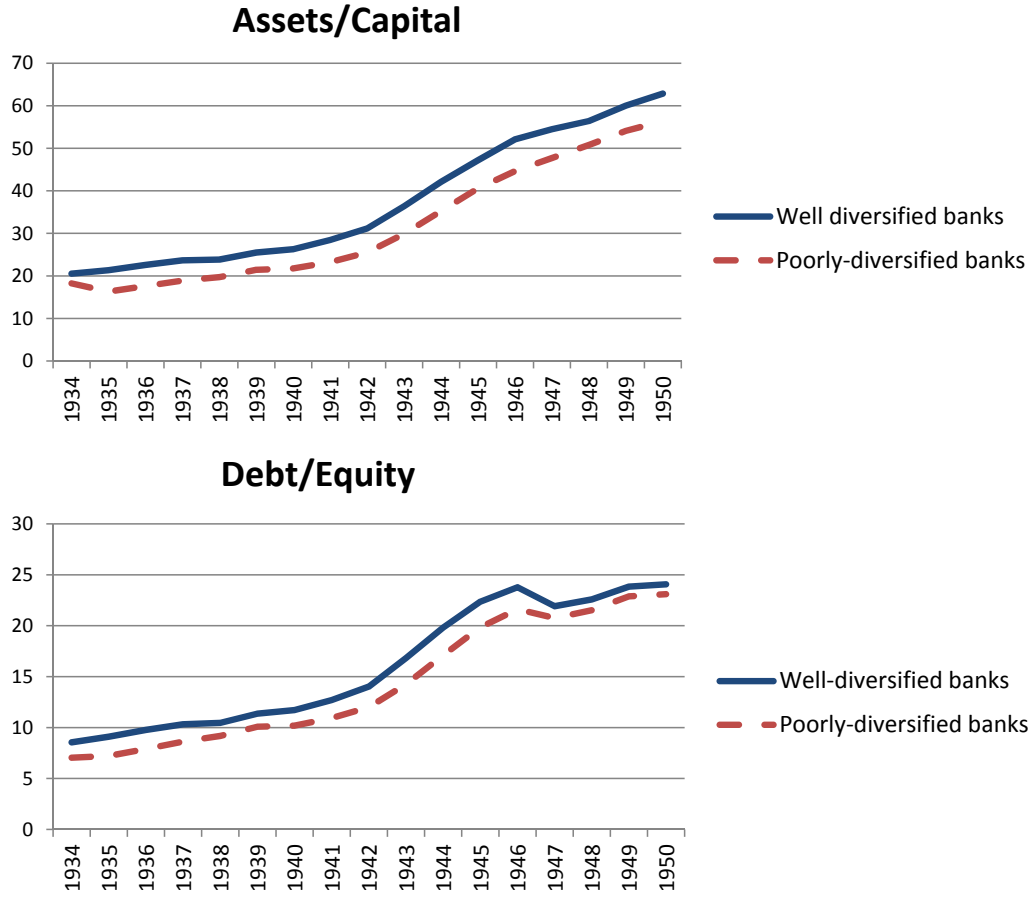


Figure 7: Leverage for well- vs poorly-diversified banks 1934-1950

diversified banks, an important feature that characterized this group was their relatively higher reliance on the note issuance as part of their financing. The notes in circulation constituted a higher share of liabilities for the badly-diversified group relative to well-diversified banks (see Table 1). As such, the law prohibiting them the note issuance had possibly a larger impact on them. This is what we find in the following section 4 in which we run panel regressions to investigate whether the abolition of double liability in Canada was accompanied by increased risk taking of chartered banks and whether this relation was statistically significant and different for well- and poorly diversified banks.

## 4 Empirical strategy and results

Having access to individual balance sheet and accounting data on chartered banks in years 1934-1950<sup>14</sup>, as well as aggregate data for loan companies, we perform panel data regression analysis for the whole sample and the subsamples of well- and badly diversified banks.<sup>15</sup> We also run the interaction effect regression for the whole sample to test whether the difference in the coefficients obtained for well- and badly-diversified banks is statistically significant. In

<sup>14</sup>No profit and dividend information is available for Barclays Bank of Canada. As such, this bank is excluded from regressions that utilize that data.

<sup>15</sup>We conduct robustness checks for the borderline cases of Bank of Nova Scotia and Bank of Toronto. Our conclusions remain unchanged.

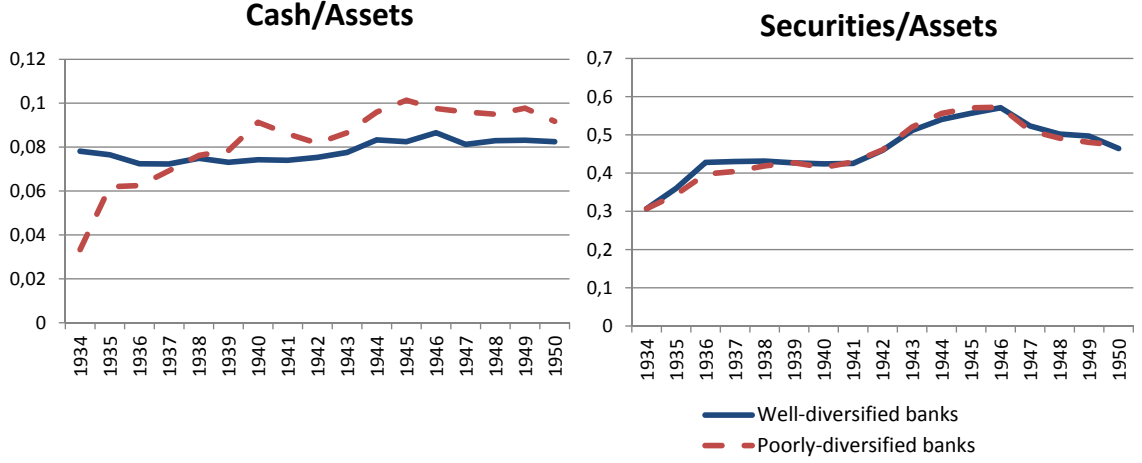


Figure 8: Asset decomposition of well- vs poorly-diversified banks 1934-1950

the subsample regressions, we focus on two basic specifications, one including the bank-fixed effects, as well as the coefficient of interest for loan companies and a war dummy as control variables (since the observations for loan companies are the same for every bank in each year, no year-fixed effects are included in this regression), and one including bank- and year-fixed effects. The latter one is more robust as loan companies differ from banks in some dimensions and as it controls for time-varying unobservables that may affect risk-taking behavior, however, the first one provides an easier economic interpretation. Loan companies were direct banks' competitors and if there was any event or trend that impacted the whole financial industry in Canada, we will be able to take this effect explicitly into account by incorporating the observation for loan companies. The regression including the data for loan companies as control variables is the following:

$$RM_{i,t} = \alpha_i + \beta NC_{i,t} + \beta_1 RMLC_t + \beta_2 B_{i,t} + \gamma D_t + \eta GDP_{i,t} + \varepsilon_{i,t}, \quad (2)$$

where  $RM$ , the dependent variable, is a risk measure for bank  $i$  in time  $t$ ,  $\alpha_i$  are bank-fixed effects,  $NC$  denotes the notes in circulation which is a proxy for the changing degree of double liability. We also control for the broad exogenous effects of changes in financial industry for financial intermediaries in Canada that might be reflected in the risk measure for loan companies ( $RMLC_t$ ), which are the closest competitors of chartered banks in the considered period. We include the total number of each bank branches (domestic and abroad)  $B_{i,t}$  in a given year, as well as the dummy  $D$  for the 2nd World War years (1939-1945). To control for local economic conditions, we use the variable  $GDP_{i,t}$  which is the sum of the net production in provinces in which a given bank had its bank branches (it varies thus for every bank in every year).  $\varepsilon_{i,t}$  is the error term. We run level regressions.

Alternatively, we consider the regression specification with bank- and year-fixed effects, which has the following form:

$$RM_{i,t} = \alpha_i + \mu_t + \beta NC_{i,t} + \beta_2 B_{i,t} + \eta GDP_{i,t} + \varepsilon_{i,t}, \quad (3)$$

where  $\mu_t$  are the year- and  $\alpha_i$  bank-fixed effects. This specification controls for the time, state and geographical location, and is thus the most robust one.

Since we consider each subsample separately, we also run an interaction term regression with bank- and year-fixed effects to test for the statistical significance of the difference between the coefficients of interest for well- and badly-diversified banks. In that case, our regression takes the form:

$$RM_{i,t} = \alpha_i + \mu_t + \beta NC_{i,t} + \zeta BD_{i,t} + \zeta_1 BD_{i,t} * NC_{i,t} + \beta_2 B_{i,t} + \eta GDP_{i,t} + \varepsilon_{i,t}, \quad (4)$$

where the dummy variable  $BD_{i,t}$  takes the value 1 for poorly-diversified banks and 0 for well-diversified banks, and the term  $BD_{i,t} * NC_{i,t}$  is the interaction term whose coefficient  $\zeta_1$  and its significance indicate whether there is a statistically significant difference between the coefficients on notes in circulation between the considered subgroups.

We take into account several risk measures for the dependent variable. First, we consider different measures for leverage, which, given the data accessibility,<sup>16</sup> is not de facto a risk-taking measure in our case. Second, we consider more explicit measures used to assess the riskiness of a bank, which we call risk-taking measures in the following paragraphs. We are mostly interested in the coefficient on the notes of circulation, as it serves as a proxy for the level of contingent liability in our regressions.

## 4.1 Leverage regressions

We take into account several leverage definitions. First, we take into account the ratio of assets to capital, as the double liability was referring to the paid-up capital in the bank. We also take into account a more general leverage ratio of assets to equity, and the debt to equity ratio. High leverage of financial institutions may amplify exogenous shocks and for that reason, a leverage ratio requirement is introduced in the regulatory framework Basel III (see Basel Committee on Banking Supervision, 2010). Even if not taking into account the risk weights on different investments, high leverage increases the dependence of considered institution on external financing and may increase the insolvency risk. However, interpreting leverage as a risk-measure in the case of this paper might be problematic, as we can not fully rule out the endogeneity problem and the capital and equity for some chartered banks remained constant in years 1934-1950, or changed only inconsiderably. As such, higher leverage reflects in our case mainly the increased balance sheet size, and not necessarily the riskiness of the balance sheet. To rule out the possibility that the balance sheet increases mainly due to the larger holdings of cash assets, we also run the regression for two leverage measures with non-cash assets. We test whether the decrease in notes in circulation (and thus, the decrease in double liability provision) was accompanied by higher leverage and whether this relation was statistically significant.<sup>17</sup>

<sup>16</sup>Given the historical nature of our paper, we face limitations on data accessibility.

<sup>17</sup>We also run the regressions with lagged notes in circulation as independent variables to test whether the change in the double liability level could have a lagged impact on the risk-taking of banks. Our results are

When we run the regressions for the whole sample, without including any interaction effects to account for the difference between well- and poorly-diversified banks, the reaction of leverage to change in contingent liability is not statistically significant, despite the strong negative correlation that could be induced from Figure 2.<sup>18</sup> The results for well- and badly diversified banks are presented in Tables 2 (for the specification with loan companies as in equation 2) and 3 (for the model with bank- and year-fixed effects as in equation 3), and the interaction-model results for the more restrictive bank- and year-fixed effects specification (only the coefficient on the interaction term) are presented in Table 8.

The regression shows that lower degree of double liability in Canada was accompanied with higher leverage among chartered banks (negative coefficient on notes of circulation means that as they decrease, i.e. double liability decreases, leverage goes in the opposite direction). This is not driven by cash hoarding by banks, as the non-cash leverage is also significantly higher with lower level of contingent liability. The coefficients on the observations for loan companies are highly statistically significant for well- and badly-diversified banks in the case of all considered leverage measures. We may note that some of the coefficients that are significant for the well-diversified banks in the first regression (Table 2), weaken or lose their significance, once bank- and time-fixed effects are considered (Table 3). In case of badly-diversified banks, the coefficient on notes of circulation (level of double liability) is highly statistically significant among all specifications, and the coefficient is one magnitude larger than for well-diversified banks. For example, looking at Table 3, we can notice that a 1 million decrease in the number of notes is associated with the increase in leverage by 0.223 for well-diversified banks (the average asset to capital ratio for these banks in that period is 37.35, so it corresponds to a 0.6% increase in leverage) and 5.26 for poorly-diversified banks (the average asset to capital ratio for these banks in that period is 31.88, so the leverage increases by 16.5%). The average number of notes in circulation issued by well-diversified banks stood at around 25.6 millions in 1934 (in year 1935, a one million decrease would thus correspond to a 3.90% decrease in the contingent liability level), while poorly-diversified banks had 5.5 million notes in circulation in 1934 (in year 1935, a one million decrease would thus correspond to a 18% decrease in the contingent liability level). The big difference in responses of poorly- versus well-diversified banks' leverage to changes in notes in circulation suggests that the difference in the strenght of responses in the two subgroups is statistically significant. The interaction-term model results, presented in Table 8 in Appendix D, confirm it.

The difference between the coefficients on notes in circulation (double liability) between the well- and poorly-diversified banks is indeed statistically significant. In the case of poorly-diversified banks, the leverage growth was linked stronger to the level of contingent liability. This result may be explained by the fact that poorly-diversified banks, although responsible for a smaller share of notes in circulation in the country-wide perspective, were holding a larger share of issued notes on the liability side of their balance sheet. In year 1934, notes in circulation

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robust to this test.

<sup>18</sup>Given the lack of significance, we chose not to present the results in the paper. The tables are available on request.

	(1)	(2)	(3)	(4)	(5)
	Assets/Capital	Assets/Equity	NC-Assets/Capital	NC-Assets/Equity	Debt/Equity
<b>Well-diversified banks</b>					
Notes in circulation (m)	-0.509** (0.16)	-0.0521 (0.08)	-0.496** (0.15)	-0.0928 (0.08)	-0.0622 (0.08)
Number of branches	-0.0155 (0.03)	-0.0639*** (0.01)	-0.00551 (0.02)	-0.0517*** (0.01)	-0.0641*** (0.01)
Dummy war years	-0.686 (1.46)	0.397 (0.66)	-0.979 (1.38)	0.119 (0.64)	0.443 (0.64)
Local GDP (m)	0.00244*** (0.00)	0.000387 (0.00)	0.00238*** (0.00)	0.000470* (0.00)	0.000338 (0.00)
Assets/Capital LC	4.499*** (1.29)				
Assets/Equity LC		9.007*** (1.57)			
NC-Assets/Capital LC			3.441** (1.20)		
NC-Assets/Equity LC				6.825*** (1.48)	
Debt/Equity LC					9.022*** (1.53)
Constant	4.029 (10.30)	10.37 (5.80)	5.511 (9.74)	13.25* (5.49)	18.02*** (4.83)
Year-fixed effects	No	No	No	No	No
Bank-fixed effects	Yes	Yes	Yes	Yes	Yes
<i>N</i>	68	68	68	68	68
R-squared	0.9508	0.9352	0.9461	0.9251	0.9372
<b>Badly-diversified banks</b>					
Notes in circulation (m)	-5.485*** (0.39)	-1.943*** (0.20)	-4.933*** (0.37)	-1.694*** (0.19)	-1.935*** (0.20)
Number of branches	0.252*** (0.04)	-0.0335 (0.02)	0.244*** (0.04)	-0.0301 (0.02)	-0.0391 (0.02)
Dummy war years	-0.871 (1.14)	1.064* (0.53)	-1.488 (1.07)	0.641 (0.50)	1.139* (0.53)
Local GDP (m)	0.000466 (0.00)	-0.000376 (0.00)	0.000572 (0.00)	-0.000248 (0.00)	-0.000441 (0.00)
Assets/Capital LC	3.300*** (0.93)				
Assets/Equity LC		8.265*** (1.10)			
NC-Assets/Capital LC			2.345** (0.88)		
NC-Assets/Equity LC				6.833*** (1.05)	
Debt/Equity LC					8.560*** (1.10)
Constant	-17.82* (7.22)	-7.130 (4.41)	-13.09 (6.66)	-3.501 (4.08)	-0.785 (3.66)
Year-fixed effects	No	No	No	No	No
Bank-fixed effects	Yes	Yes	Yes	Yes	Yes
<i>N</i>	102	102	102	102	102
R-squared	0.9493	0.9300	0.9432	0.9149	0.9279

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

NC stands for Non-Cash, LC stands for Loan Companies.

The regressions do not include bank- or year-fixed effects.

Table 2: Level regression for each subsample with variables for loan companies included as controls, leverage ratios

	(1)	(2)	(3)	(4)	(5)
	Assets/Capital	Assets/Equity	NC-Assets/Capital	NC-Assets/Equity	Debt/Equity
<b>Well-diversified banks</b>					
Notes in Circulation (m)	-0.223 (0.13)	-0.197** (0.07)	-0.166 (0.13)	-0.164* (0.07)	-0.218** (0.07)
Number of branches	0.0492* (0.02)	-0.0334** (0.01)	0.0464* (0.02)	-0.0302** (0.01)	-0.0348** (0.01)
Local GDP (m)	-0.127 (0.14)	-0.387*** (0.08)	-0.0749 (0.14)	-0.342*** (0.07)	-0.403*** (0.08)
Constant	283.5 (309.72)	898.3*** (173.35)	165.1 (305.21)	794.4*** (164.68)	932.4*** (170.47)
Year-fixed effects	Yes	Yes	Yes	Yes	Yes
Bank-fixed effects	Yes	Yes	Yes	Yes	Yes
<i>N</i>	68	68	68	68	68
R-squared	0.9880	0.9773	0.9860	0.9751	0.9777
<b>Badly-diversified banks</b>					
Notes in Circulation (m)	-5.262*** (0.41)	-1.969*** (0.19)	-4.840*** (0.39)	-1.810*** (0.20)	-2.091*** (0.21)
Number of branches	0.346*** (0.05)	0.0612** (0.02)	0.319*** (0.04)	0.0409 (0.02)	0.0444 (0.02)
Local GDP (m)	0.00100 (0.00)	-0.00238*** (0.00)	0.000822 (0.00)	-0.00233*** (0.00)	-0.00286*** (0.00)
Constant	-4.838 (6.73)	15.73*** (3.12)	-3.624 (6.31)	17.02*** (3.18)	17.57*** (3.39)
Year-fixed effects	Yes	Yes	Yes	Yes	Yes
Bank-fixed effects	Yes	Yes	Yes	Yes	Yes
<i>N</i>	102	102	102	102	102
R-squared	0.9684	0.9614	0.9652	0.9471	0.9540

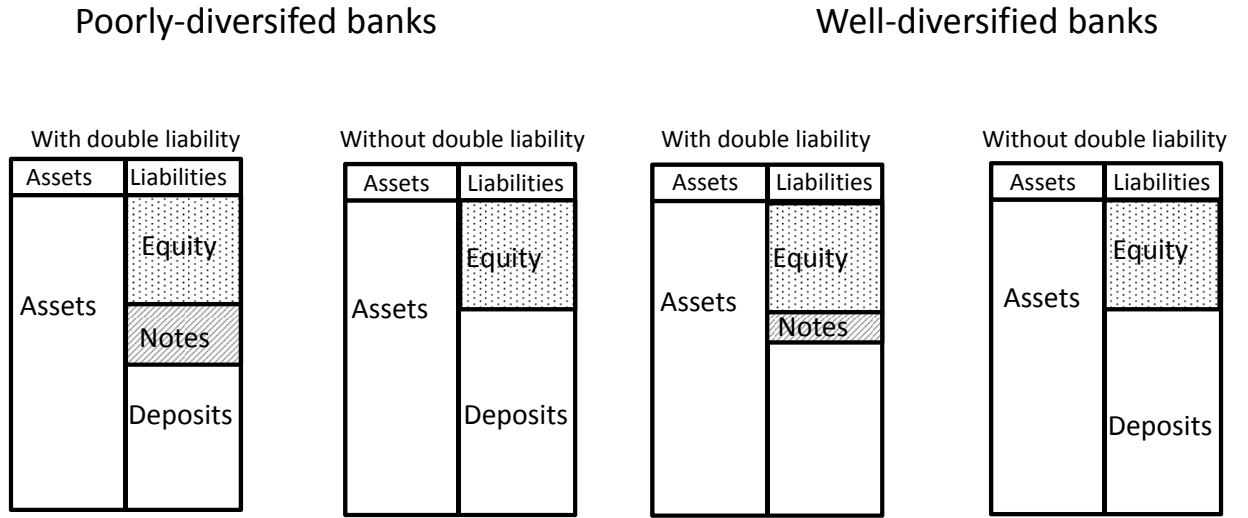
Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

NC stands for Non-Cash, LC stands for Loan Companies.

Table 3: Level regression for each subsample with bank- and year-fixed effects, leverage ratios

constituted 5.7% of liabilities for poorly-diversified banks, while in the case of the well-diversified banks the share of notes in circulation in all liabilities was 4.5%. To graphically illustrate that result, let's assume that apart from the share of notes in their liabilities, poorly- and well-diversified banks have the same balance sheet characteristics, and that after the abolition of double liability, they hold their balance sheet size constant. Conditioning on that, the reduction of the number of issued notes increases the leverage defined as debt to equity through the simple balance sheet effect, and it does so more for banks that had more notes in circulation in the first place, as presented in Figure 9.



Define leverage ( $l$ ) as Deposits/Equity, denote period with double liability as  $t=0$ , and period without double liability as  $t=1$ . Then for poorly- (PD) and well-diversified (WD) banks, it holds:

$$l_{PD,1} - l_{PD,0} > l_{WD,1} - l_{WD,0}$$

Figure 9: Static balance sheet effect of decreasing the number of issued notes on leverage

Figure 9 illustrates why the impact of reducing the notes of circulation on poorly-diversified banks was stronger than on well-diversified banks in a static framework and assuming a constant balance sheet size. However, Figure 7 demonstrates that leverage increases also due to the increase in the assets, i.e. the balance sheet size increases for both well- and poorly-diversified banks in the period of the abolition of double liability, which may be an indication for increased risk-taking. Without detailed information on the composition of the banks' assets we are not able to rule this possibility out, but descriptive evidence indicates that increased balance sheets of chartered banks in Canada in period 1934-1950 were not a sign of increased risk-taking. Although we exclude cash hoarding as the main reason driving the leverage, it is noticeable that in the considered period the ratio of loans to assets decreased for both types of bank, while the ratio of securities to assets increased (see Figure 8). Digging into the historical literature on Canadian financial system, we find support for our interpretation of no increased risk-taking resulting from higher leverage in that period. Referring to a longer time period than considered



in this paper, Neufeld (1972), p. 113 and 116, writes: *“The period from 1873 to 1970 was one in which loans (excluding call and day-to-day loans) decreased in relative importance, accounting for 72.8% of total assets in the 1873-5 period and 49.8% in the 1961-5 period, with 50.9% at the end of 1970; and it was a period in which security holdings rose substantially in importance, being negligible in 1873-5 and amounting to 19% at the end of 1970. (...) The shift into securities (...) reflected the growing utilization by corporations, municipalities and provinces of the developing new issues market for raising funds. (...) two factors caused a permanent change in the chartered banks’ investment practices: the First World War financing, which greatly increased the banks’ holdings of federal government securities, and the banks’ sad (almost fatal in one case) experience with railway financing, which made them shy away from corporate securities in general. As a consequence of these factors the banks’ holdings of federal and provincial government securities jumped (...) this pattern was never altered after that (although it was greatly accentuated by federal government financing during the 1930s depression and the Second World War) (...) It is apparent (...) that the steady decline in the relative importance of bank loans among assets after the 1911-15 period had its counterpart not only in an increase in security holdings but in holdings of increasingly more liquid securities.”*

## 4.2 Risk-taking measure regressions

In the second step of our empirical analysis, we turn to the analysis of different risk-measures and we examine how they are linked to the change in the contingent liability. We take into account one balance sheet measure: loans to deposits ratio, and three measures which make use of the accounting data: the volatility of ROA (return on assets), z-score, and profits divided by the standard deviation of profits in the considered time period. We use loans to deposits ratio, as it is in focus of the recent Basel regulation (Basel Committee on Banking Supervision, 2013), imposing a certain liquidity coverage ratio on banks. The higher the loans to deposits ratio, the less liquid is the bank. When it comes to more explicit risk-taking measures, the volatility of returns and the z-score are common indicators (Laeven and Levine, 2009; Köhler, 2012). We assess the volatility of bank returns by looking at profits divided by the standard deviation of them in the considered period, as well as the volatility of ROA, defined as a 3-year moving average of returns on assets. Additionally, we take into account the z-score, which is defined as the ratio of the return on assets plus the capital ratio (actually, the equity to assets ratio) divided by the standard deviation of the return on assets over the considered time period. The formula for the z-score is the following:

$$Z - Score_{i,t} = \frac{ROA_{i,t} + CAR_{i,t}}{SDROA_i} \quad (5)$$

As noted in Laeven and Levine (2009), Z-score is a highly skewed measure, so, following the literature, we use the log of the calculated z-score in our regressions. Z-score is interpreted as the inverse of the probability of insolvency, and it indicates a lower bound for number of standard deviations returns have to drop below expected in order to exhaust the bank’s equity.

It is often used as an alternative to the distance to default measure when the market data is unavailable. Eyeballing the data, we see that in years 1934-50, the z-score decreased for both well- and badly-diversified banks, but only the panel data regression can assess the strength of this trend and its link to the changes in double liability.

The results of regressions for well- and poorly-diversified banks are presented in Tables 4 (regression with loan companies as controls) and 5 (regression with bank- and year fixed effects), and the Table 9 in Appendix D presents the results of the interaction-term regression with bank- and year-fixed effects, which allows us to assess the significance in the different response of well- vs poorly-diversified banks.

Looking at the results of the regression presented in Table 4, it is evident that the degree of double liability (the coefficient on notes in circulation) had only a marginal effect on the risk-taking of well-diversified banks. However, the coefficient on ROA volatility is significantly positive, and on profits in relation to their standard deviation, significantly negative, suggesting that with a lower degree of contingent liability, ROA volatility decreases and profits in relation to their volatility increase, which could be interpreted as lower risk insolvency for well-diversified banks. Once both bank- and year-state effects are taken into consideration (Table 5), only the profit result remains significant. A one million decrease in notes in circulation, corresponding to a 3.90% decrease in the double liability in 1935, was accompanied by an increase of profits to standard deviation of profits by around 2%. For the poorly-diversified banks, the coefficients on loans to deposits ratio and ROA volatility are statistically significant and goes in the same direction for both regression specifications, suggesting lower insolvency risk. Positive coefficients on the z-score and the profits in relation to their standard deviation (Table 4) lose their significance, once also time-fixed effects are considered (Table 5). Moreover, if we look at the results presented in Table 5, the coefficient on the z-score is not significant for both subgroups. As such, at poorly-diversified banks, lower levels of contingent liability were accompanied by lower proportion of loans in the asset portfolio and lower ROA volatility, which may indicate their decreased riskiness. The average ROA volatility for poorly-diversified banks in period 1934-1950 stood at 1.56%, so the positive coefficient of 0.000276 corresponds to a decrease in ROA volatility by around 1.76% accompanying a decrease in notes in circulation by one million (in year 1935, that would correspond to a 18% decrease in the contingent liability level), which is an economically significant decrease. Moreover, the positive coefficient of 0.0346 for loans to deposits ratio of poorly-diversified banks whose average loans to deposits ratio in the considered period amounted to 36% means that on average, a one million decrease in notes in circulation was accompanied by 9.6% decrease in the loan to deposits ratio, i.e. less loans were created out of existing deposits. When we look at the interaction-term regression to test for the significance in the difference between well- and badly-diversified banks, it turns out that the difference is significant for loans to deposits ratio and ROA volatility, indicating that poorly-diversified banks became significantly safer in the wake of the change in regulation.

If we run the regression on the whole sample, its results, presented in Table 6 mostly confirm our conclusions from subsample analysis. The coefficient on the Z-score is negative and

	(1) Loans/Deposits	(2) Z-score	(3) ROA volatility	(4) Profits/St.dev.profits
<b>Well-diversified banks</b>				
Notes in circulation (m)	0.000853 (0.00)	-0.00448 (0.01)	0.0000323* (0.00)	-0.0599* (0.03)
Dummy war years	-0.000488 (0.01)	-0.0387 (0.04)	0.0000948 (0.00)	-0.178 (0.21)
Number of branches	0.00156*** (0.00)	0.00310*** (0.00)	-0.00000281 (0.00)	0.0179*** (0.00)
Local GDP (m)	-0.000000358 (0.00)	-0.0000665*** (0.00)	5.17e-08 (0.00)	-0.00000701 (0.00)
Loans/Deposits LC	0.0493*** (0.01)			
Z-score LC		2.064*** (0.42)		
ROA volatility LC			0.0143 (0.03)	
Profits/St.dev.profits LC				0.223 (0.14)
Constant	-0.540*** (0.09)	-5.570** (1.83)	0.000936 (0.00)	-3.078 (1.63)
Year-fixed effects	No	No	No	No
Bank-fixed effects	Yes	Yes	Yes	Yes
<i>N</i>	68	68	60	68
R-squared	0.8831	0.9141	0.2179	0.6934
<b>Badly-diversified banks</b>				
Notes in circulation (m)	0.0459*** (0.01)	0.0977*** (0.01)	0.000217** (0.00)	0.552*** (0.13)
Dummy war years	-0.0393*** (0.01)	-0.0206 (0.02)	0.000194 (0.00)	0.300 (0.25)
Number of branches	0.00174** (0.00)	0.00394*** (0.00)	-0.0000159* (0.00)	0.0214 (0.01)
Local GDP (m)	0.0000206*** (0.00)	-0.0000144 (0.00)	0.000000139* (0.00)	0.000410** (0.00)
Loans/Deposits LC	0.0395*** (0.01)			
Z-score LC		2.114*** (0.25)		
ROA volatility LC			0.00000594 (0.00)	
Profits/St.dev.profits LC				-0.0641 (0.16)
Constant	-0.182* (0.07)	-6.048*** (1.08)	0.00184 (0.00)	-0.891 (1.63)
Year-fixed effects	No	No	No	No
Bank-fixed effects	Yes	Yes	Yes	Yes
<i>N</i>	102	85	75	85
R-squared	0.8326	0.9665	0.3046	0.3585

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Data on profits is missing for the Barclays Bank of Canada. We take the log of the z-score.

Table 4: Level regression for each subsample with variables for loan companies included as controls, risk-taking measures

	(1) Loans/Deposits	(2) Z-score	(3) ROA volatility	(4) Profits/St.dev.profits
<b>Well-diversified banks</b>				
Notes in circulation (m)	0.000126 (0.00)	-0.00318 (0.00)	0.00000871 (0.00)	-0.122*** (0.03)
Number of branches	0.00126*** (0.00)	0.000130 (0.00)	0.00000473 (0.00)	0.00989* (0.00)
Local GDP (m)	-0.000964 (0.00)	0.0162*** (0.00)	0.00000292 (0.00)	-0.0343 (0.03)
Constant	2.043 (4.00)	-31.83*** (7.15)	-0.00902 (0.04)	80.00 (60.54)
Year-fixed effects	Yes	Yes	Yes	Yes
Bank-fixed effects	Yes	Yes	Yes	Yes
<i>N</i>	68	68	60	68
R-squared	0.9499	0.9882	0.6851	0.8929
<b>Badly-diversified banks</b>				
Notes in circulation (m)	0.0349*** (0.00)	0.0185 (0.01)	0.000276** (0.00)	0.323 (0.22)
Number of branches	0.000885 (0.00)	0.00161 (0.00)	0.00000756 (0.00)	0.0166 (0.01)
Local GDP (m)	-0.0000136 (0.00)	0.00000684 (0.00)	-0.000000151 (0.00)	0.000972** (0.00)
Constant	0.272*** (0.08)	3.515*** (0.15)	-0.00147 (0.00)	-0.0975 (2.36)
Year-fixed effects	Yes	Yes	Yes	Yes
Bank-fixed effects	Yes	Yes	Yes	Yes
<i>N</i>	102	85	75	85
R-squared	0.9042	0.9896	0.7789	0.5342

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Data on profits is missing for the Barclays Bank of Canada. We take the log of the z-score.

Table 5: Level regression for each subsample with bank- and year-fixed effects, risk-taking measures

	(1) Loans/Deposits	(2) Z-score	(3) ROA volatility	(4) Profits/St.dev.profits
Notes in circulation (m)	0.000148 (0.00)	-0.0120*** (0.00)	-0.0000264* (0.00)	-0.109*** (0.02)
Branches	0.000454 (0.00)	0.00104** (0.00)	0.00000662** (0.00)	0.0180*** (0.00)
Local GDP (m)	-0.0334** (0.01)	-0.00910 (0.02)	-0.000263* (0.00)	0.621** (0.21)
Constant	0.500*** (0.07)	3.966*** (0.10)	-0.000326 (0.00)	0.545 (1.29)
Year-fixed effects	Yes	Yes	Yes	Yes
Bank-fixed effects	Yes	Yes	Yes	Yes
$N$	170	153	135	153
R-squared	0.8536	0.9847	0.6157	0.6214

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Data on profits is missing for the Barclays Bank of Canada. We take the log of the z-score.

Table 6: Risk-measure regression for the whole sample with bank- and year-fixed effects

statistically significant, which means that under lower levels of contingent liability, the Z-score is higher, indicating a lower probability of insolvency of Canadian banks. The coefficient on profits in relation to their standard deviation also indicates that direction. Only the negative coefficient on the ROA volatility is not in line with our interpretation of results, as it may suggest an increase in the ROA volatility under lower levels of contingent liability, but it is only barely significant.

Overall, although an obvious concern is that the results presented do not reflect the causal impact of the abolition of double liability on bank risk-taking, they hold across different specifications and robustness checks. They point in the direction that the abolition of double liability in Canada was not accompanied by higher risk-taking of chartered banks. The banks became safer, and this result is mainly driven by poorly-diversified banks which react significantly different to the change in regulation than well-diversified banks. We explain this difference in results for well- and poorly-diversified banks, relating to the monitoring theory. When double liability was abolished, the depositors of smaller and poorer-diversified banks were more exposed to the insolvency risk, so they increased their monitoring. As Saunders and Wilson (1995) write (p. 11): “bank creditors have incentives to monitor the erosion of double liability. As erosion occurs, creditors will demand higher premiums as compensation for bearing greater risk.” This compensation is likely to be higher for the creditors of banks more exposed to insolvency risk due to their lower degree of diversification.

## 5 Conclusion

Using historical balance sheets and accounting data of chartered banks in Canada, we examine the period of the gradual abolition of the double liability in Canada with the focus on the risk-taking and lending behavior of banks. Conducting a panel data analysis and taking into account the geographical diversification possibilities of banks, we find that lower degrees of contingent liability in Canada were not accompanied by higher bank risk-taking. The leverage of banks increased in the considered period, but it was mainly due to their shift towards investment in liquid government securities, and it reflected their growing balance sheets. When we take into account more explicit risk-taking measures, we find barely any relation between the level of contingent liability and risk taking for well-diversified banks. For poorly-diversified banks we find that they actually became safer under lower levels of contingent liability. We explain this result and the significant difference in the reaction of the two subgroups by referring to the monitoring incentives of depositors who increase their monitoring activities after the abolition of double liability mostly for poorly-diversified banks, which, *ceteris paribus*, have higher insolvency risk than well-diversified banks. The interpretation focusing on the monitoring role of depositors under different liability regimes is in line with findings and conclusions of Bodenhorn (2015) and Macey and Miller (1992) for U.S.

Our results suggest that the abolition of the double liability in Canada had a stronger impact on monitoring activities of depositors rather than risk-taking behavior of banks. The reason for that may be found in the tight regulation of chartered banks that created entry barriers for potential new competitors. That led to the development of oligopoly in the Canadian banking market, and as Bordo et al. (2015), p.219, write, it was a: *“grand bargain whereby the chartered banks would provide financial stability in exchange for the Canadian government limiting entry to the industry.”* Moreover, the periodical rechartering of banks provided shareholders with incentives to prudently engage in risk-taking activities, otherwise their charter could have been not prolonged. In such a regulatory regime, in the absence of deposit insurance, the level of contingent liability seems to have had more impact on depositors rather than bank shareholders.

Moreover, the results of our paper are in line with the literature stressing the importance of branching and uniform regulation for the stability of the Canadian banking system (Bordo, Redish, and Rockoff, 2015; Calomiris and Haber, 2014), albeit we do not provide explicit evidence for the importance of these features of the Canadian banking system, as we narrow our analysis to the effects of abolition of contingent liability in Canada. What matters most for the stability of the banking system is creating the framework in which incentives between depositors, shareholders and regulators are aligned. A perfect division of responsibilities between the three groups of agents is probably not possible, but it seems that Canada managed to find a sustainable equilibrium, in which a change in one regulation towards potential increased riskiness did not actually lead to a higher risk.

## References

- ACHESON, G. AND J. TURNER (2006): “The impact of limited liability on ownership and control: Irish banking 1877-1914,” *Economic History Review*, 59, 320–346.
- (2008): “The death blow to unlimited liability in Victorian Britain: The City of Glasgow failure,” *Explorations in Economic History*, 235–253.
- ADMATI, A. AND M. HELLWIG (2013): *The Bankers’ New Clothes: What’s Wrong with Banking and What to Do about It*, vol. 1 of *Economics Books*, Princeton University Press.
- ADMATI, A. R. AND P. PFLEIDERER (2009): “Increased-Liability Equity: A Proposal to Improve Capital Regulation of Large Financial Institutions,” Research Papers 2043, Stanford University, Graduate School of Business.
- AGGRAWAL, R., R. RAO, AND T. HIRAKI (1989): “Skewness and Kurtosis in Japanese equity returns: empirical evidence,” *Journal of Financial Research*, 253–260.
- ARDITTI, F. (1967): “Risk and the required rate of return,” *Journal of Finance*, 19–36.
- ASCAH, R. L. (1999): *Politics and Public Debt. The Dominion, the Banks and Alberta’s Social Credit*, The University of Alberta Press.
- BASEL COMMITTEE ON BANKING SUPERVISION (2010): “Basel III: A global regulatory framework for more resilient banks and banking systems,” .
- (2013): “Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools,” .
- BODENHORN, H. (2015): “Double Liability at Early American Banks,” *NBER Working Paper*.
- BORDO, M., A. REDISH, AND H. ROCKOFF (2015): “Why didn’t Canada have a banking crisis in 2008 (or in 1930, or 1907, or ...)?” *The Economic History Review*, 218–243.
- BORDO, M. D. AND A. REDISH (1987): “Why Did the Bank of Canada Emerge in 1935?” *The Journal of Economic History*, 47, 405–417.
- BRECKENRIDGE, R. M. (1910): *The History of Banking in Canada*, Washington: Government Printing Office.
- CALOMIRIS, C. W. (1990): “Is Deposit Insurance Necessary? A Historical Perspective,” *The Journal of Economic History*, 50, 283–295.
- CALOMIRIS, C. W. AND S. H. HABER (2014): *Fragile by Design: The Political Origins of Banking Crises and Scarce Credit*, Princeton University Press.
- CARR, J., F. MATHEWSON, AND N. QUIGLEY (1995): “Stability in the Absence of Deposit Insurance: The Canadian Banking System, 1890-1966,” *Journal of Money, Credit and Banking*, 27, 1137–58.

- CURTISS, C. (1948): "Banking," in *The Encyklopedia of Canada*, ed. by S. Wallace, University Associates of Canada, 151–164.
- DIAMOND, D. W. AND P. H. DYBVIG (1983): "Bank Runs, Deposit Insurance, and Liquidity," *Journal of Political Economy*, 91, 401–19.
- DIXON, F. (1935): "Monetary and Banking Legislation in Canada, 1934," *The American Economic Review*, 73–84.
- ENCYCLOPAEDIA BRITANNICA ONLINE (2015): "History of Canada," <http://www.britannica.com/EBchecked/topic/91513/Canada>, accessed: 2015-05-11.
- ESTY, B. C. (1998): "The impact of contingent liability on commercial bank risk taking," *Journal of Financial Economics*, 47, 189 – 218.
- FAMA, E. (1965): "The behavior of stock market prices," *Journal of Business*, 34–105.
- GROSSMAN, R. AND M. IMAI (2013): "Contingent capital and bank risk-taking among British banks before the First World War," *Economic History Review*, 66, 132–155.
- GROSSMAN, R. S. (2001): "Double Liability and Bank Risk Taking," *Journal of Money, Credit and Banking*, 33, pp. 143–159.
- GRUBEL, H. (1968): "Internationally diversified portfolios: welfare gains and capital flows," *The American Economic Review*, 1299–1314.
- HENDRICKSON, J. (2014): "Contingent liability, capital requirements, and financial reform," *Cato Journal*, 129–144.
- HICKSON, C. AND J. TURNER (2003): "The trading of unlimited liability bank shares in nineteenth-century Ireland: The Bagehot Hypothesis," *The Journal of Economic History*, 63, 931–958.
- KÖHLER, M. (2012): "Which banks are more risky? The impact of loan growth and business model on bank risk-taking," *Deutsche Bundesbank Discussion Paper*.
- KRYZANOWSKI, L. AND G. S. ROBERTS (1993): "Canadian Banking Solvency, 1922-1940," *Journal of Money, Credit and Banking*, 25, 361–76.
- LAEVEN, L. AND R. LEVINE (2009): "Bank governance, regulation and risk taking," *Journal of Financial Economics*, 93, 259 – 275.
- LEVY, H. AND M. SARNAT (1970): "International diversification of investment portfolios," *The American Economic Review*, 668–675.
- MACEY, J. R. AND G. P. MILLER (1992): "Double Liability of Bank Shareholders: History and Implications," *Faculty Scholarship Series. Yale Law School*.



- MARQUIS, R. W. AND F. P. SMITH (1937): "Double Liability for Bank Stock," *The American Economic Review*, 27, pp. 490–502.
- MCDOWALL, D. (1993): *Quick to the Frontier. Canada's Royal Bank*, McClelland & Stewart Inc.
- MCLAUGHLIN, S. (1995): "The impact of interstate banking and branching reform: evidence from the states," *Current Issues in Economics and Finance*, 1.
- MITCHENER, K. J. AND G. RICHARDSON (2013): "Does skin in the game reduce risk taking? Leverage, liability and the long-run consequences of new deal banking reforms," *Explorations in Economic History*, 50, 508–525.
- NEUFELD, E. (1964): *Money and Banking in Canada*, McGill-Queen's Press.
- (1972): *The Financial System of Canada. Its Growth and Development*, St. Martin's Press, New York.
- NIXON, S. E., J. BRYDEN, AND W. HACKETT (1937): "Interest Rates in Canada," *The Canadian Journal of Economics and Political Science*, 3, 421–448.
- NOISEUX, M. H. (2002): "Canadian Bank Mergers, Rescues and Failures," Ph.D. thesis, Concordia University, Montreal.
- POSCHMANN, F. (2014): "Shareholder Liability: A New (Old) Way of Thinking about Financial Regulation," *C.D. Howe Institute Commentary*.
- SAUNDERS, A. AND B. WILSON (1995): "Contingent liability in banking : useful policy for developing countries?" .
- SCOTT, R. AND P. HORVATH (1980): "On the direction of preferences for moments of higher order than the variance," *Journal of Finance*, 915–919.
- TANG, G. (1994): "Diversification and Intervaling effects: an empirical study on interaction," *The Review of Business Studies*, 67–88.
- TANG, G. AND D. CHOI (1998): "Impact of diversification on the distribution of stock returns: international evidence," *Journal of Economics and Finance*, 119–127.
- WALKER, B. (1894): "Banking in Canada," *Economic Journal*, 227–248.
- WILSON, B. K. AND E. J. KANE (1996): "The Demise of Double Liability as an Optimal Contract for Large-Bank Stockholders," *NBER Working Paper*.

## A Regional diversification in Canada and foreign branches of Canadian chartered banks

We analyze the regional diversification of each Canadian bank, starting from a short summary of population and net production data for each province.<sup>19</sup> Considering population, net production and branching data, we calculate averages of the percentage contribution of each province to the Canadian aggregate in years 1934-1950.

In the considered time period (1934-1950), the most populated Canadian province was Ontario. Its population accounted for around 33% of the total Canadian population. The population of the second most-populated province, Quebec, on average accounted for slightly less than 29% of the total Canadian population. British Columbia's and Saskatchewan's population accounted for around 7.5% of the population, the population of Alberta for 6.8%, Manitoba: 6.2%, Nova Scotia: 4.97%, New Brunswick: 3.91%. The population of P.E. Island made up 0.79% of the Canadian population, the population of Newfoundland that joined the Canadian Confederation in 1949: 0.3%, and the least populated province (actually a territory, listed though as a province in the Canadian statistical annuals), Yukon: 0.05%.

With respect to net production, Ontario accounted on average for 42% of the Canadian net production, Quebec had the second highest contribution with 26.5%, while British Columbia had the third highest contribution with 8.46%. Alberta's net production accounted for 6.49%, Saskatchewan's for 5.73%, Manitoba's for 4.76%, Nova Scotia's for 3.04%, New Brunswick's for 2.28%, Newfoundland's for 0.83%, P.E. Island's for 0.34% and Yukon's for 0.13%. Such a distribution of population and production implied that the richest province in terms of per capita production was Yukon, followed by Ontario, British Columbia and Alberta.

Was this distribution of population and net production mirrored in the localization of the Canadian bank branches? If we look at the average number of bank branches for all banks in the period 1934-1950 in Canada, we note that bank branches situated in Ontario accounted for around 40% of all branches in Canadian provinces, which is in line with the population and the net production data. 22% Canadian banks' branches were located in Quebec, 8.75% in Saskatchewan, 7.3% in British Columbia, 6.7% in Alberta, 5.9% in Manitoba, 4.8% in Nova Scotia, 3.2% in New Brunswick, 1% in Newfoundland, 0.84% in P.E. Island and 0.2% in Yukon. Table 7 summarizes the ordering of provinces according to their relative contribution to the Canadian economy. We see that the rankings are very similar. Saskatchewan is a notable case, because it has more bank branches and a lower production than its population would suggest.

Canadian banks also opened their branches in foreign countries. Foreign countries with the highest number of Canadian bank branches included Cuba, British West Indies, Newfoundland (until it became part of Canadian Confederation in 1949), Puerto Rico, United States and England. Some Canadian banks did not have any branches abroad: Bank of Toronto, Banque Provinciale du Canada, Imperial Bank of Canada and Barclays Bank of Canada. The Canadian

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<sup>19</sup>Although Yukon is formally a Canadian territory, and not a province, the data for Yukon are provided in the Canada Year Books as if it were a province. Regarding Newfoundland, it became part of Canada in 1949.

Ranking	Population	Net production	Number of bank branches
1	Ontario	Ontario	Ontario
2	Quebec	Quebec	Quebec
3	British Columbia	British Columbia	Saskatchewan
4	Saskatchewan	Alberta	British Columbia
5	Alberta	Saskatchewan	Alberta
6	Manitoba	Manitoba	Manitoba
7	Nova Scotia	Nova Scotia	Nova Scotia
8	New Brunswick	New Brunswick	New Brunswick
9	P.E. Island	Newfoundland	Newfoundland
10	Newfoundland	P.E. Island	P.E. Island
11	Yukon	Yukon	Yukon

Table 7: Canadian provinces' contribution to the Canadian economy (calculated on the basis of an average for years 1934-1950)

engagement in the British West Indies located on Carribean islands was linked to the fact that they were a British colony and Canadian banks performed there, along with British banks, colonial monetary functions. In the case of Puerto Rico and Cuba, Canadian banks profited from the unit banking system in the U.S. and played an intermediary role for U.S. companies due to the lack of a developed American banking presence on the islands. As McDowall (1993) writes, p. 167: *"It was ironic (...) that in the very years in which America was building the most powerful national economy in the world, its banks remained localized, limited in any hope of effective national coverage, let alone international expansion"*. At the beginning of the 20th century, as a result of the Spanish-American war, Cuba turned from a Spanish colony into a protectorate of the United States. Due to the military occupation of the island, there were many Americans in Cuba that were in need of banking services. The U.S. became also the largest trading partner of Cuba and the Canadian banks were playing the role of U.S. bankers there.

B Bank branches for all ten chartered banks with a division in provinces

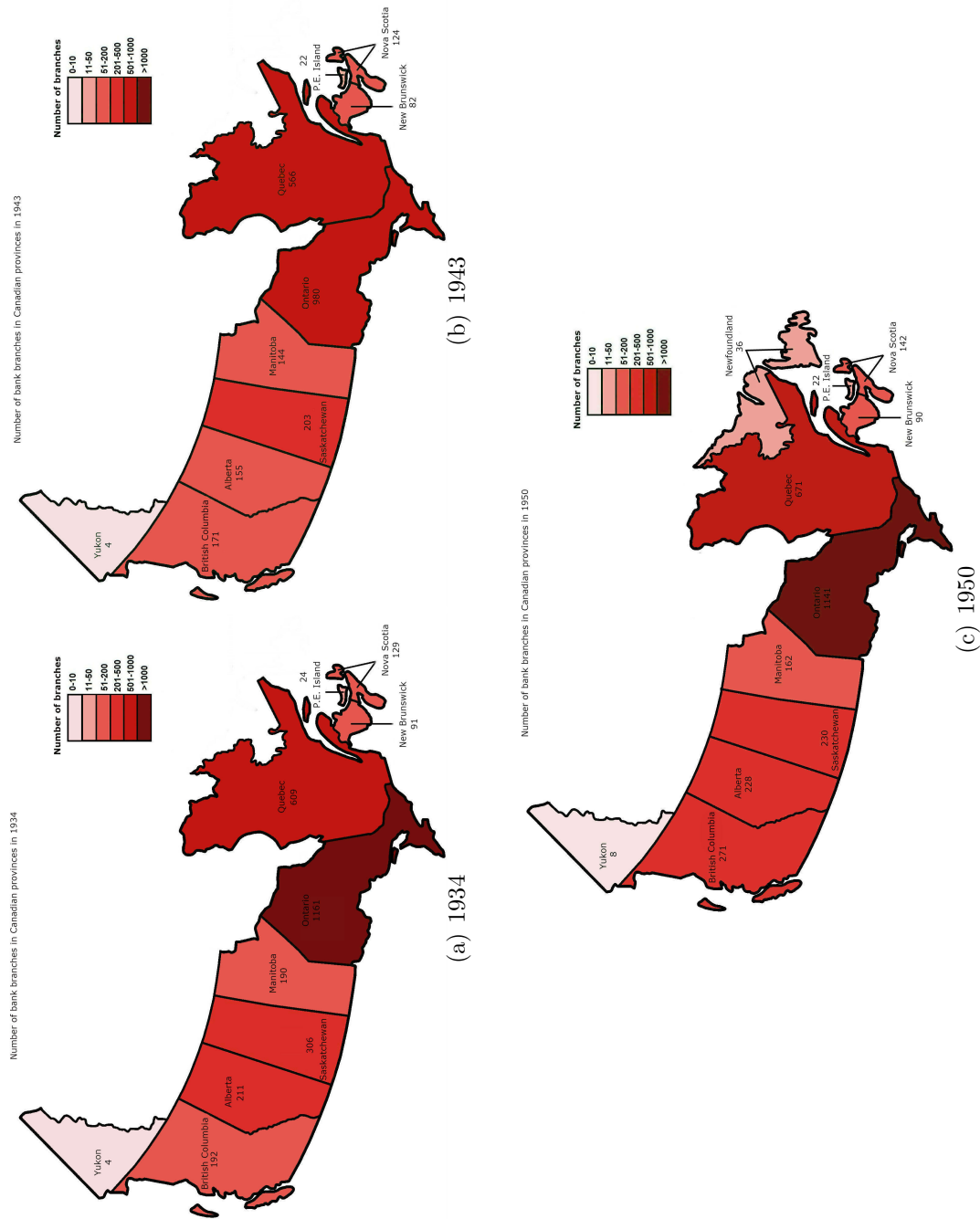


Figure 10: Bank branches of all Canadian banks in 1934, 1943 and 1950

## C Bank branches for individual banks with a division in provinces

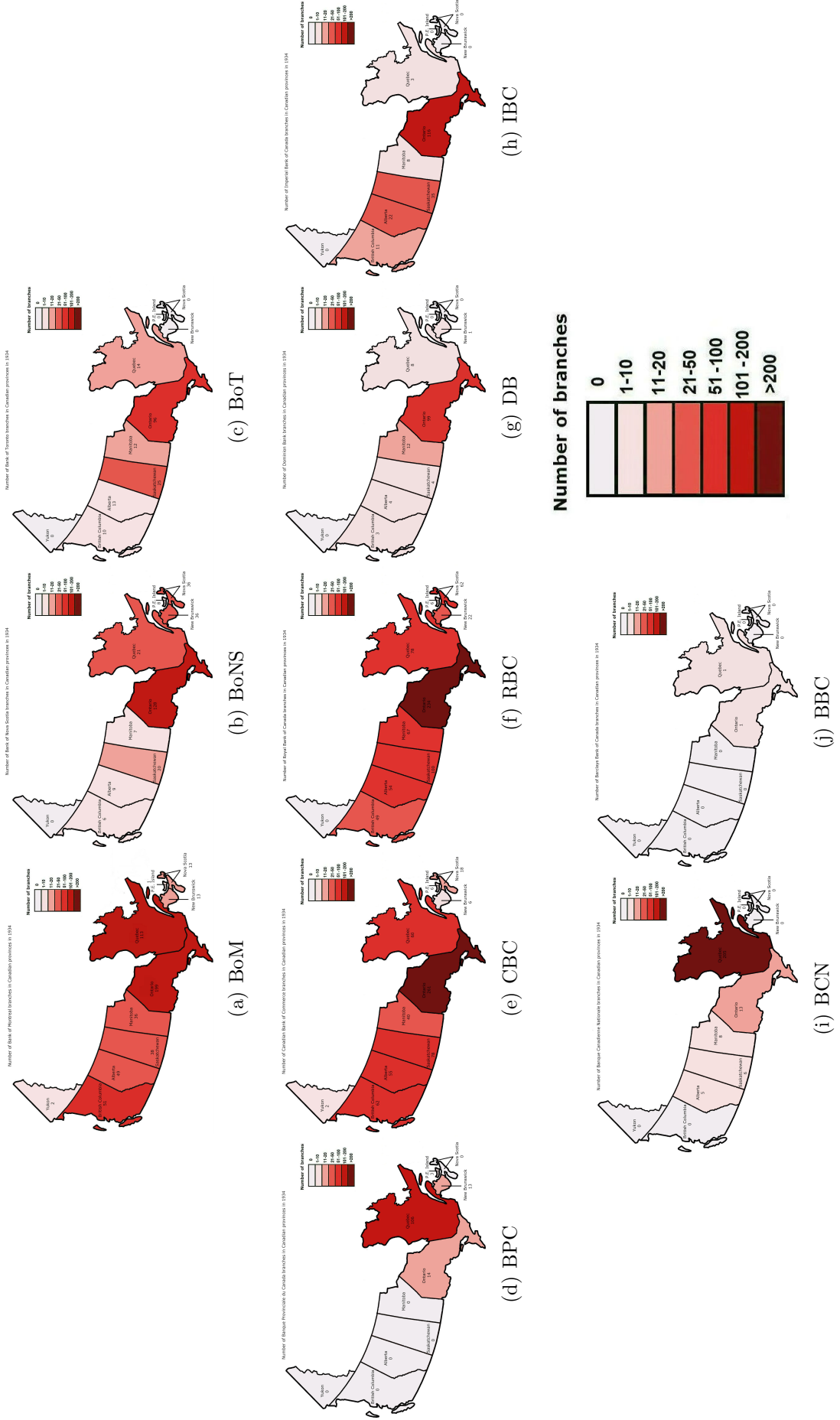


Figure 11: Individual banks' branches with a division in provinces in 1934

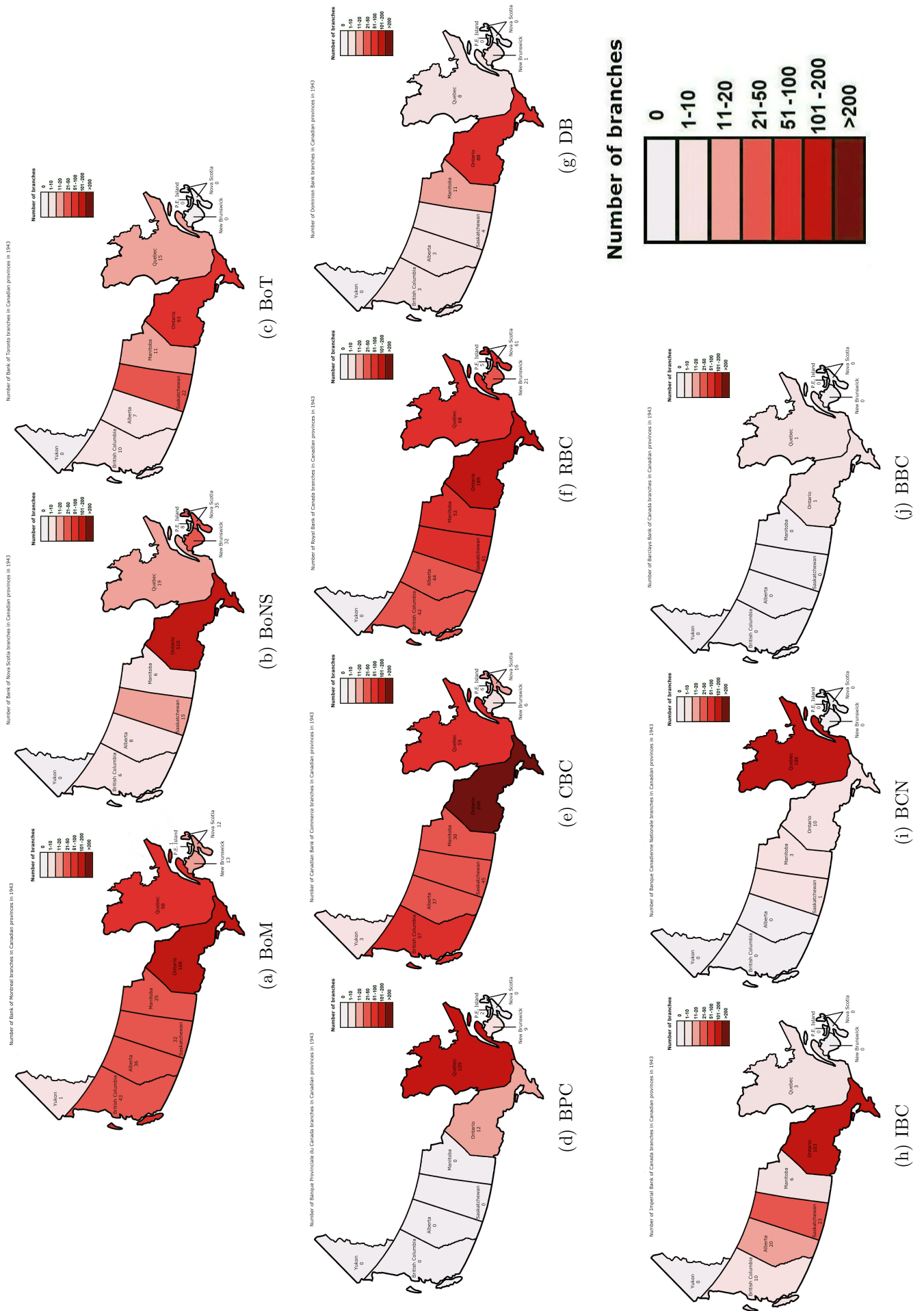


Figure 12: Individual banks' branches with a division in provinces in 1943

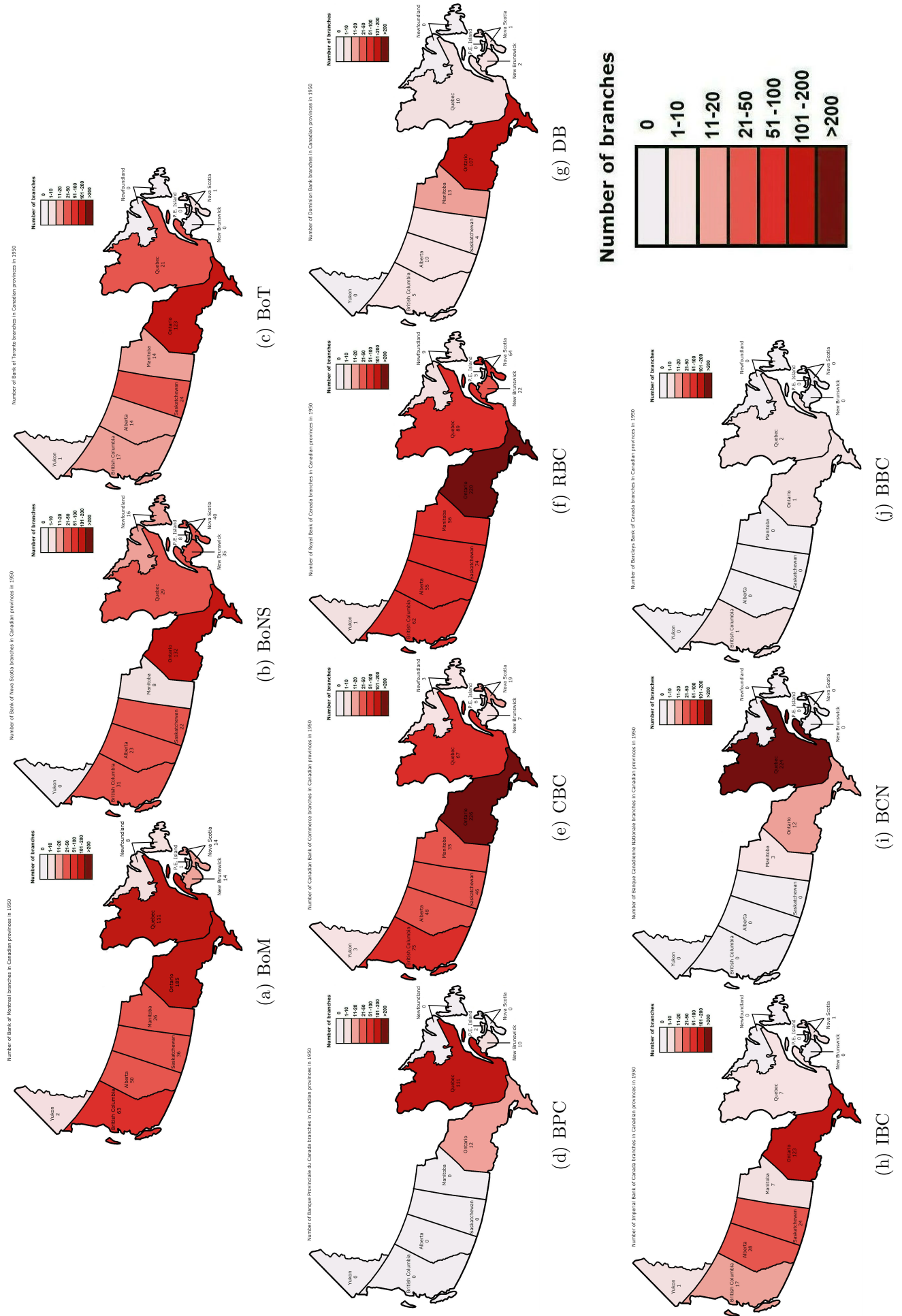


Figure 13: Individual banks' branches with a division in provinces in 1950

## D Interaction-term model results

	(1)	(2)	(3)	(4)	(5)
	Assets/Capital	Assets/Equity	NC-Assets/Capital	NC-Assets/Equity	Debt/Equity
$BD_{i,t} * NC_{i,t}$	-2.842*** (0.30)	-1.101*** (0.13)	-2.505*** (0.29)	-0.934*** (0.13)	-1.158*** (0.14)
Year-fixed effects	Yes	Yes	Yes	Yes	Yes
Bank-fixed effects	Yes	Yes	Yes	Yes	Yes
$N$	170	170	170	170	170
R-squared	0.552	0.9516	0.9652	0.9500	0.9404

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

NC stands for Non-Cash, LC stands for Loan Companies.

$BD_{i,t} * NC_{i,t}$  refers to the interaction term in the interaction-term regression.

Table 8: Interaction-term model for the whole sample

	(1)	(2)	(3)	(4)
	Loans/Deposits	Z-score	ROA volatility	Profits/St.dev.profits
$BD_{i,t} * NC_{i,t}$	0.0264*** (0.00)	0.00487 (0.01)	0.000151*** (0.00)	0.0293 (0.08)
Year-fixed effects	Yes	Yes	Yes	Yes
Bank-fixed effects	Yes	Yes	Yes	Yes
$N$	170	153	135	153
R-squared	0.9099	0.9848	0.6779	0.6218

Standard errors in parentheses

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

Data on profits is missing for the Barclays Bank of Canada. We take the log of the z-score.

$BD_{i,t} * NC_{i,t}$  refers to the interaction term in the interaction-term regression.

Table 9: Interaction-term model for the whole sample with bank- and year-fixed effects



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SPEEDING UP MCMC BY DELAYED ACCEPTANCE AND DATA SUBSAMPLING <i>by MATIAS QUIROZ</i>	2015:307
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