The Moral Hazard Effects of Unlimited Deposit Insurance: Evidence from Canadian Credit Unions

A Thesis Submitted to the

College of Graduate and Postdoctoral Studies

In Partial Fulfillment of the Requirements

For the Degree of Master of Public Policy

In the Johnson-Shoyama Graduate School of Public Policy

University of Saskatchewan

Saskatoon

Elham Charkhkar

Permission to Use

In presenting this thesis/dissertation in partial fulfillment of the requirements for a Postgraduate degree from the University of Saskatchewan, I agree that the Libraries of this University may make it freely available for inspection. I further agree that permission for copying of this thesis/dissertation in any manner, in whole or in part, for scholarly purposes may be granted by the professor or professors who supervised my thesis/dissertation work or, in their absence, by the Head of the Department or the Dean of the College in which my thesis work was done. It is understood that any copying or publication or use of this thesis/dissertation or parts thereof for financial gain shall not be allowed without my written permission. It is also understood that due recognition shall be given to me and to the University of Saskatchewan in any scholarly use which may be made of any material in my thesis/dissertation.

Disclaimer

This thesis was exclusively created to meet the thesis and/or exhibition requirements for the degree of Master of Public Policy at the University of Saskatchewan. Reference in this thesis/dissertation to any specific commercial products, process, or service by trade name, trademark, manufacturer, or otherwise, does not constitute or imply its endorsement, recommendation, or favoring by the University of Saskatchewan. The views and opinions of the author expressed herein do not state or reflect those of the University of Saskatchewan and shall not be used for advertising or product endorsement purposes.

Requests for permission to copy or to make other uses of materials in this thesis/dissertation in whole or part should be addressed to:

Director of the Johnson-Shoyama Graduate School of Public Policy

Diefenbaker Building

University of Saskatchewan

101 Diefenbaker Place Saskatoon

Saskatchewan S7N 5B8 Canada

OR

Dean College of Graduate and Postdoctoral Studies

University of Saskatchewan

116 Thorvaldson Building

110 Science Place Saskatoon

Saskatchewan S7N 5C9 Canada

Table of Contents

List of Tables

List of Figures

Acknowledgements

First and foremost, I would like to extend my sincerest thanks to my supervisor, Dr. Marc-Andre Pigeon, for his unwavering support, encouragement, and constructive guidance, which was vital for completing my thesis. His constructive and detailed comments have helped me transform my manuscript into the thesis it is today.

I am also grateful to my committee members, Dr. Murray Fulton and Dr. Abdullah Mamun, who provided me with insightful comments. Aside from being my committee member, it was a privilege to participate in Dr. Fulton's classes; his enthusiasm about public policy and economics is infectious, and I sincerely appreciate his time for encouraging and educating me throughout my program. I am grateful to Dr. Mamun for his constructive insight and patience through my thesis.

Thanks also goes to JSGS professors, particularly to Dr. Margot Hulbert for her informative class, and her support; and to all wonderful staff at JSGS including Amy Hassett and Doug O'Brian for providing support, valuable advice, and a friendly atmosphere during my study at JSGS.

My final word goes to my family and friends, although we are far from each other, their love and support are with me.

The Moral Hazard Effects of Unlimited Deposit Insurance: Evidence from Canadian Credit Unions

Abstract

The objective of this study is to examine whether British Columbia's adoption of unlimited deposit insurance in 2008 encouraged risk-taking behaviour among provincially-constituted credit unions after the financial crisis. The purpose of deposit insurance is to encourage confidence among depositors by covering some, or all, of their deposit in the case of bank failure. However, this policy can have side effects. These side effects, known as a moral hazard, can incentivize bank risk-taking behaviour and in so doing, paradoxically, compromise the very financial stability deposit insurance is meant to achieve. Therefore, deposit insurance can both enhance the depositor's confidence and encourage risk-taking behaviour among financial institutions. While there is an abundance of empirical studies that examine whether the benefits of deposit insurance outweigh the drawbacks for banks, there have been very few such studies conducted on credit unions, particularly for Canadian credit unions. British Columbia's adoption of unlimited deposit insurance (from $100,000 previously) in the midst of the financial crisis presents a unique opportunity to examine the influence of policy change on risk-taking behaviour in credit unions. To investigate this matter, this thesis applied the difference-in-difference and comparative interrupted time series methods for the period from 1997 to 2018, comparing the experience of British Columbia credit unions with those of credit unions in the province of Ontario, which kept its coverage constant at $100,000 until 2018. The results from both the methodologies failed to provide any evidence that the policy change contributed to an increase in risk-taking behaviour by British Columbia credit unions; in fact, I observed a decrease in risk-taking behaviour, contrary to what theory predicted. I argue that these findings might be explained by the unique features of credit unions, paired with strong regulatory oversight.

Chapter 1: Introduction

Deposit insurance is a policy for preventing bank runs and protecting customer deposits. It typically consists of a promise to depositors that some or all their deposits will be repaid in the event of a bank failure (Diamond & Dybvig, 1983). This policy may however induce financial institutions to engage in risky endeavors because it removes or diminishes depositors' incentives to monitor their financial institutions (Angkinand & Wihlborg, 2010). With reduced monitoring, the managers of financial institutions may have more incentive to take on risky projects, knowing that if the project succeeds, they will reap the rewards and if it fails, the cost will be covered by deposit insurance; this change in incentive and behaviour is known as a moral hazard[1] (Varian, 2010).

1.1 Background

In the language of insurance, moral hazard is a form of asymmetric information that takes the form of a hidden action; theory predicts that individuals with insurance will take insufficient care of their now-insured belongings (Varian, 2010). For example, a person who insures their bicycle against theft may not safeguard their bicycle as diligently as they would have done before buying insurance because they know that if their bicycle is stolen, the insurer will reimburse them for their loss (Varian, 2010). Because the insurer cannot monitor the activities of the insurance holders, these actions are hidden (Varian, 2010). Likewise, in the banking industry, deposit insurance can lead to moral hazard because it reduces the incentives for depositors to monitor behaviour: If the bank's risk taking is successful, the managers reap higher returns; if it fails, the insurer pays the cost (Varian, 2010).

The focus of this thesis is moral hazard in the context of the deposit insurance guarantee provided to members of Canadian credit unions. Credit unions are financial institutions that are like banks but with some unique features. Their business model and governance distinguish them from banks in that credit unions are not-for-profit financial consumer co-operatives. In credit unions, ownership and control of the organization is vested in its members rather than investors. Because control is in the hands of members, service takes precedence over profit maximization (Ferguson & McKillop, 1997). Compared to the customers of commercial banks, members of credit unions may have expectations that they will receive better service, higher

[1] It should be noted that while deposit insurance may weaken depositors' incentive to monitor their financial institutions, if the financial environment is transparent, the incentive for governments and regulators to monitor financial institutions may offset the resulting increase in moral hazard. This point is discussed in the literature review section of the thesis.

interest on deposits, and lower rates on loans or cash dividends (i.e., patronage returns; Deller & Sundaram-Stukel, 2012; Tokle et al., 2015).

The literature suggests that credit unions, because they are co-operatives, are likely to be more risk averse than chartered banks (Drake & Llewellyn, 2001). Therefore, deposit insurance may not incentivize credit unions to engage in risky endeavors as it may do for banks. There are several possible reasons for why credit unions may be more risk averse (Drake & Llewellyn, 2001). First, because co-operatives do not prioritize maximizing profit, they may not be incentivized to the same extent as banks to take the risks required to see high returns on investment (Drake & Llewellyn, 2001). Second, co-operatives may not be as myopic in their business decisions as conventional banks because they focus on the long-term interests of their members and the communities in which they operate (Drake & Llewellyn, 2001). Third, as co-operatives, credit unions must carefully manage their capital since they cannot raise external capital as easily as banks. Finally, conflicts of interest about agency may be less severe in the co-operative than in the bank since members of co-operatives are also the owners (Drake & Llewellyn, 2001; Llewellyn & Holmes, 1991) though some have expressed concern about the ability of a diffuse membership to properly monitor management, particularly as credit unions grow in size and complexity. This increase in scale makes collective decisions by numerous owners difficult if not impossible (Hoel, 2011).

From a policy perspective, determining whether deposit insurance encourages risk-taking in credit unions is important because Canadian credit unions have a significant share of the country's banking assets, and many people depend on their success. One way to measure the credit unions' role in banking is to look at the penetration rate, which is the ratio of credit union members to the financially active population of the country aged 15-64. In Canada, the penetration rate of credit unions, including Quebec-based credit unions called caisses, is 42% (World Council of Credit Union, 2020). Credit unions and caisses play a crucial role in providing financial services to many communities and to small businesses, providing the only bricks-and-mortar services in hundreds of communities across Canada.[2] The credit union system outside of Quebec has won Canadian Customer Service Excellence Awards for 16 years in a row (Ipsos, 2020). Desjardins caisses have not. Again, outside the province of Québec, credit unions are particularly important in western Canada. In British Columbia for example, credit unions serve 41% of the population. In Saskatchewan, credit union membership is 41% of the provincial population, and, in Manitoba it is 50% (Canadian Credit Union Association, 2021). In short, if deposit insurance in credit unions leads to excessive risk-taking behaviour, broad financial stability in the banking system and the financial well-being of millions of Canadians may be jeopardized.

[2] For the rest of this analysis, I focus largely on credit unions outside the province of Québec because of that province's unique and much more highly centralized system and because its deposit insurance scheme is nearly identical to the federal scheme.

Canadian credit unions are regulated differently from Canadian commercial banks. The Office of Superintendent of Financial Institutions (OSFI) regulates commercial banks federally, while all but two credit unions are regulated provincially. As a result, the provinces are responsible for credit union deposit insurance schemes and related policies including coverage amounts, which differ in scope and amount by province. While commercial banks' deposits are insured up to $100,000 per account,[3] credit union members generally have higher deposit insurance coverage. For example, credit union members in the western provinces, including the Prairie Provinces and British Columbia, have access to unlimited deposit insurance. While deposit insurance has been unlimited in Manitoba, Saskatchewan, and Alberta for decades, deposit insurance in British Columbia was limited to $100,000 prior to 2008, when it was increased to unlimited. In other provinces, deposit insurance coverage for credit unions varies from $100,000 (Quebec) to $250,000[4] (Ontario, New Brunswick, Nova Scotia, and Newfoundland).[5] These jurisdictional differences in deposit insurance coverage provide an opportunity for a quasi-experimental study, in which I can assess the causal impact of British Columbia's adoption of unlimited deposit insurance coverage in 2008 by contrasting it with the experience in Ontario, which kept its coverage for credit unions constant at $100,000 until 2018.

Although the relationship between deposit insurance and the moral hazard problem has been widely researched, only a few studies have examined the influence of unlimited deposit insurance on risk-taking behaviour. Moreover, there are very few studies on deposit insurance specific to credit unions (Cihak & Hesse, 2007). A literature review conducted for this study revealed that there is only one published study (i.e., Atanasova et al., 2019) about the impact of unlimited deposit insurance on Canadian credit unions' risk-taking behaviour. This paper and its findings are discussed later in the literature review section. Finally, while some scholars argue that credit unions may have less incentive to assume risky behaviour because of their unique ownership and governance structure (Amess & Howcrot, 2001), others point out that this hypothesis has not been adequately researched (Smith & Woodbury, 2010).

Understanding risk-taking behaviour is an important research question and a live policy question, as banks and their representatives – notably the Canadian Bankers Association (CBA) – have long complained to provincial and federal policymakers that unlimited deposit insurance

[3] The available coverage to any one person, however, can be increased to as much as $700,000 through a practice known as stacking, whereby a bank customer spreads their deposits across a range of accounts (e.g., one owner, joint accounts, RRSP, TFSA, trust accounts, RRIFs, and mortgage accounts). Coverage can be multiplied by repeating the process across financial institutions, sometimes within the same corporate conglomerate (e.g., Royal Bank and Royal Trust).

[4] In Ontario, deposit insurance coverage is $250,000 for general deposits, but for registered deposits (in tax-sheltered plans), credit unions have unlimited coverage.

[5] It is possible to "stack" coverage in these provinces as well.

gives credit unions an unfair competitive advantage and/or poses risks to the financial system (Canadian Bankers Association, 2015; International Monetary Fund, 2014; Poschmann, 2014).

1.2 Problem Statement and Research Objective

Credit unions in British Columbia have been operating under an unlimited deposit insurance scheme since 2008, and the literature suggests that the switch to this kind of scheme may lead to moral hazard problems. The purpose of this thesis is to examine the influence of unlimited deposit insurance on moral hazard in British Columbia credit unions. The impact of deposit insurance on banks' risk-taking behaviour has been widely studied; nevertheless, more research is needed to understand how and under which conditions deposit insurance leads to moral hazard. The gap is particularly glaring for Canadian credit unions. To the best of my knowledge, the impact of increasing deposit insurance to unlimited coverage has been studied in Canadian credit unions only in one study. In fact, little research has been conducted in Canada on credit unions' risk-taking behaviour in general. This study contributes to the literature on credit unions and seeks to determine what holds true for the relationship between moral hazard and deposit insurance in the context of credit unions in British Columbia. This thesis is important because unlimited deposit insurance is highly unusual, and its theorized effect on moral hazard is significant.

1.3 Organization of Thesis

The remainder of this thesis is organized as follows: Chapter 2 provides a theoretical overview of deposit insurance and moral hazard. Chapter 3 reviews the history of Canadian deposit insurance both in banks and credit unions. Chapters 4 and 5 describe the literature review and methodology of this study, respectively. Chapter 6 is about policy implications and policy difficulties, and Chapter 7 offers concluding thoughts.

Chapter 2: Review of Deposit Insurance and Moral Hazard

2.1 Reasons for the Adoption of Deposit Insurance Policy

The principal business of banking for credit unions and banks is taking demandable deposits and making loans. These tasks may result in what is known as an asset/liability mismatch (Armour, 2018): Depositors can request their money from demand accounts (e.g., chequing or savings accounts) when they wish, but banking entities cannot readily liquidate their loan assets to match the outflow of funds if there is a mass withdrawal, as occurs in a bank run (Armour, 2018; Anginer & Demirguc-Kunt, 2018; Ngalawa et al., 2016). Mass withdrawals occur when depositors predict that their bank may go into insolvency and are thus concerned about losing their deposits. Because banks pay depositors their money on a first-come, first-served basis, when depositors fear insolvency, they may rush to the bank to retrieve their deposit (Anginer & Demirguc-Kunt, 2018). When a bank run occurs, banks cannot readily liquidate long-term loans without the risk of incurring significant losses, as panicked selling depresses prices (Anginer & Demirguc-Kunt, 2018).

It is important to note that since the banking system is interconnected, the failure of one bank can undermine the solvency of other banks. Consequently, bank failure can adversely impact the whole financial and economic system, and exacerbate the losses incurred when banks attempt to sell their assets to meet withdrawal demands (Diamond & Dybvig, 1983). An example of this interconnectedness can be illustrated by the failure of Canadian Commercial Banks (CCB) and the Northland Bank. The failure of these two banks resulted in financial difficulty for Bank of British Columbia and Continental Bank of Canada, which relied on CCB and the Northland Bank for their wholesale deposit funding. Ultimately, Bank of British Columbia and Continental Bank of Canada could not continue their operations and merged with other banks (Dingle, 2003)

Deposit insurance can provide a financial safety net by assuring depositors that they will not lose their deposit if their bank collapses; in this way, deposit insurance enhances the stability of banks by diminishing the possibility of contagious bank failure (Anginer & Demirguc-Kunt, 2018; Diamond & Dybvig, 1983;). As a result, policymakers have introduced deposit insurance schemes to prevent bank runs and minimize the risk of systemic events.

2.2 How Deposit Insurance Creates Moral Hazard

Despite the benefit of deposit insurance, it also has a drawback. Adopting deposit insurance can lead to excessively risky behaviour in the banking industry because deposit insurance not only lulls depositors into a sense of security and dampens their incentive to exercise market discipline; it may also incentivize banks to engage in riskier projects (Calomiris & Kahn, 1991). In the absence of deposit insurance, depositors have at least some incentives to monitor and

assess the financial condition of their banks. If depositors decide that the portfolio of a bank is riskier than expected, or banks' reservoirs of capital appear to be inadequate to absorb losses from the higher risk, they can either withdraw their money or demand an elevated interest rate on their deposits to compensate for higher risk. The possibility that depositors can withdraw their deposit —or demand a higher deposit rate—enforces market discipline because it internalizes the bank's cost of borrowing (Calomiris & Kahn, 1991). An increase in the cost of borrowing has the potential to curb banks' penchant for risk (Calomiris & Kahn, 1991; Karel & McClatchey, 1999).

Another way that the adoption of deposit insurance can lead to moral hazard is through the mispricing of deposit insurance premiums. Determining the premium is difficult because banks have different risk appetites and estimation of these appetites may not only be inaccurate but will also invariably be based on past risks instead of on future risks (Lambert, 2017). In the risk-based premium design, after the premium is determined, banks take on new risks and start to play a new risky game (Anginer & Demirguc-Kunt, 2018). If regulators cannot effectively determine future risk and consequently are unable to determine or demand the appropriate risk premium, banks may take on excessive risk (Lambert et al., 2017). This behaviour occurs because banks know that if they take on risky loans, they will either reap the rewards of these decisions or, if the opportunity fails, deposit insurance will cover the losses (Cooper & Ross, 2002; Krugman, 2009).

Chapter 3: The Canadian Context for Deposit Insurance

3.1 Introduction

Around the world, deposit insurance has become a near universal policy to protect depositors from the devastating consequences of bank failures. Although deposit insurance may be taken for granted nowadays, it has not always existed. In this chapter, after briefly reviewing the history of the Canadian banking system, I describe the events that led to the adoption of deposit insurance in Canadian chartered banks. I follow that discussion by reviewing the events that led to the introduction of deposit insurance in credit unions.

3.2 The Canadian Banking System

To better understand the evolution of deposit insurance in credit unions, it is important to set that discussion in context and understand the broader banking system and the federal government's adoption of a formal deposit insurance regime for banks in 1967. This understanding is especially relevant because the early versions of credit union deposit insurance were designed primarily as stabilization funds, helping to recapitalize or provide liquidity to struggling credit unions so that they could avoid a deposit insurance payout. These stabilization funds officially morphed into deposit insurers after the Canada Deposit Insurance Corporation (CDIC) came into being, which will be discussed in section 3.4.

While the United States adopted deposit insurance in 1933, the Canadian federal government did not adopt deposit insurance until more than three decades later in 1967. Canada's later adoption of deposit insurance can be attributed to the stability of the Canadian financial system (Savage, 2014(. This stability has been attributed to three features of the Canadian approach to regulating banks: the periodic revision of the *Bank Act*, branch banking, and—until the mid-20th century—the use of double liability (Calomiris & Haber, 2014; Savage, 2014).

Adopted in 1871, the *Bank Act* gives the federal government responsibility for banking regulations. It includes a legislative process of periodic revision. The *Bank Act* was revised every 10 years until 1992 and every five years thereafter (Kobrak & Martin, 2018). This periodic revision ensures that regulations are flexible and adaptive, allowing for measured responses to evolving circumstances and periodic crises (Freeman, 1998; Savage, 2014).

Branch banking was introduced in 1867 (Grodecka & Kotidis, 2016). Branch banking means that Canada has only a few major banks that expand their operations through the country by branching, spreading the mobility and diversification of risk over a wider geographical area (Kobrak & Martin, 2018). Through branch banking, financial systems become resilient because the loan risk is diversified, and the investment is distributed (Grodecka & Kotidis; 2016).

Double liability was passed in 1870 and meant that stockholders could suffer the cost of bank failure twice (Grodecka & Kotidis, 2016). The first instance would be a loss of their initial investment in the failed bank; the second instance would be through the compensation of some of the bank's losses. The responsibility of the stockholder to pay this additional compensation was limited to the amount of the original investment. Stockholders were exposed to the possibility of being required to help fund the bank and absorb some of the losses in case of bankruptcy (Carr et al., 1995; Kyer, 2017; Savage, 2014; Wagster, 2007). Double liability increased stockholders' vested interest in bank solvency; therefore, it was possible to rely largely on stockholder monitoring to curb excessive risky behaviour in banks (Kyer, 2017).

Although double liability delivered significant loss prevention to depositors (Beckhart et al., 1929), double liability made raising capital difficult (Savage, 2014). During the Great Depression, policymakers decided to end double liability, reasoning that the benefits to depositors did not outweigh the difficulty in raising capital (Savage, 2014). The *Bank Act* of 1934 removed 75% of the double liability for the following 10 years, and then in 1944, the *Bank Act* was amended so that the remaining double liability would be removed by the beginning of 1950 (Wagster, 2007).

3.3 The Adoption of Deposit Insurance in Banks

The stability in the Canadian banking system was not perfect however, a fact best demonstrated by the collapse, in 1923, of the Toronto-based Home Bank. More than 50,000 depositors suffered significant monetary losses due to its failure. Following this financial loss and related efforts to salvage the bank, discussions about, and interest in, the idea of deposit insurance came to the forefront in Parliament (Kyer, 2017). Ultimately, this event did not lead to the immediate adoption of deposit insurance, but it would influence debates about deposit insurance for decades to come. More tangibly and immediately, it led to the creation of the Office of the Inspector General of Banks (OIGB) in 1924 to improve federal supervision (Kyer, 2017; Savage, 2014). However, the OIGB lacked the capacity to properly exercise its function (Kyer, 2017). For example, as recently as 1984, OIGB had fewer than 14 employees to oversee all of Canada's banks.

Ultimately, however, it was the different regulations among chartered banks and provincial financial institutions (i.e., trust companies and credit unions) that paved the way for the adoption of deposit insurance. One of the features of the Canadian banking system is that banking regulation for chartered banks occurs at the federal level, while credit unions and trust companies are regulated provincially. Particularly, the rules for such provincially regulated financial institutions are not as rigid as they are for federally regulated banks (MacGregor, 1966). One of these differing regulations was related to the interest rate on loans. In the 1960s,

banks had to restrict interest rates on loans and mortgages to 6% and under (Kyer, 2017; Savage, 2014). Accordingly, when interest rates rose, banks could not effectively compete in the mortgage market. This paved the way for the emergence and proliferation of trust and loan companies as well as life insurance companies and credit unions, ultimately enabling them to offer nearly the same services as banks and earning them the label of near banks. These entities had unhindered access to supply funds to meet the growing demand for home mortgages (Kyer, 2017). For example, from 1933 to 1964, credit unions grew significantly. Their total assets grew from $10 million in 1933 to more than $1.5 billion in 1964 (Savage, 2014).

The increase in the number of institutions offering near-bank services in the 1960s created intense competition and highlighted the need for consistent regulation. Because of interest rate ceilings, competition intensified among these deposit-taking institutions; and concerns began to emerge about what the growing role of these near-banks might mean for the conduct of monetary policy but also the financial well-being of Canadians (Kyer, 2017). These concerns were rooted in the fact that provincial regulatory practice over the near banks diverged from those of the federal government and its banks (Kyer, 2017). In 1964, a Royal Commission, called the Porter Commission, endorsed the idea that trust companies offering services similar to banks could be covered under the Bank Act (Wagster, 2007). One suggestion for bringing in uniform regulation was a mandatory deposit insurance program that would encompass both federal and provincial financial institutions (Wagster, 2007). This solution, however, was controversial because some people argued that, according to the Canadian Constitution, this would amount to federal interference with the rights of provinces (Wagster, 2007). Therefore, this solution was not adopted (Wagster, 2007).

The need for increased monitoring of deposit-taking institutions was becoming increasingly obvious, and another financial institution's failure ultimately led to the adoption of deposit insurance (Kyer, 2017). In 1965, the provincially chartered Atlantic Acceptance Corporation, one of the top financial companies of the time, failed. Subsequently, the British Mortgage & Trust Company, which had a close financial relationship with the Atlantic Acceptance Corporation, almost failed (Kyer, 2017). As a result, the Ontario government announced that it would support these financial companies to prevent any losses to depositors, effectively preventing a bank run (Kyer, 2017). These events prompted the federal government to create a Canada Deposit Insurance Corporation (CDIC) in 1967. Its deposit insurance scheme applied to all federally regulated banks and trust companies (Kyer, 2017).

The goal of the CDIC was similar to that of the Federal Deposit Insurance Corporation (FDIC) in the United States: both aimed to establish consistent standards for all financial institutions (Kyer, 2017). In Canada, the federal government could not mandate consistent standards across provinces without encroaching on provincial rights (Kyer, 2017; Wagster, 2007). To avoid possible constitutional conflict between provincial and federal authorities, the federal government chose to give provincial trust companies the *option* of joining CDIC (Kyer, 2017; Wagster, 2007); by contrast, CDIC membership was mandatory for banks (Kyer, 2017).

Interestingly, however, the CDIC did not include credit unions under its voluntary support, even though credit unions like many trust companies were governed provincially (Schroeder, 1983). Credit unions were not included under the CDIC membership because the then federal Minister of Finance, Mitchell Sharp, argued that credit unions were self-sufficient (Schroeder, 1983). Sharp offered three additional reasons for the refusal. First, they had provincial mutual aid or stabilization funds that offered what was effectively deposit insurance; second, they offered services only to their own members and so were not a public financial entity; and third, credit unions made up only a small portion of deposit-taking institutions, so they were unlikely to adversely influence the financial system (Schroeder, 1983).

3.4 Deposit Insurance in Credit Unions

During the 1950s, the need for deposit insurance and oversight in credit unions became clear after two rural Saskatchewan credit unions misappropriated funds. The first case happened in 1950 in the town of St. Gregor, where the manager took deposits and split them among his personal accounts (Schroeder, 1983). The second occurred in Arran, where there was a loss of $71,000, and although the location of the money could not be determined, it became clear that the manager was the culprit (Schroeder, 1983). Despite the losses incurred at these credit unions, their respective members did not withdraw their money since they thought there would be a better chance to recoup the loss if they stayed with the credit unions (Schroeder, 1983). Following these incidents, leaders of credit unions reached an agreement to create a stabilization fund that would help sort out any financial difficulties experienced by credit unions and, in so doing, help protect member deposits (Schroeder, 1983). Subsequently, in 1953, in order to find a long-term solution, the Saskatchewan Mutual Aid Board (MAB) was created. It was the first such organization to provide stabilization funds for credit unions in Canada outside of Quebec. Like its counterpart in Québec, it was seen as a means of managing credit union liquidation and providing what was effectively a deposit insurance scheme (The Credit Union Deposit Insurance Corporation of Saskatchewan, 2020). The MAB had oversight over the Mutual Aid Fund, which was funded by mandatory levies on credit unions. The MAB used the accumulated fund to assist or wind down problem credit unions and in so doing, help prevent financial crises in credit unions (Schroeder, 1983) and limit demands on the implicit deposit insurance promise.

Inspired by Saskatchewan, British Columbia realized the need for a stabilization fund after Britannia Beach Credit Union experienced a deposit run and was forced to close after the

shuttering of British Columbia's largest copper mine in the one-industry town by the same name (Stevenson, 1993). Following this, in 1959, the credit unions working with the province created the Credit Unions Reserve Board (CURB), a stabilization entity similar to Saskatchewan's mutual aid board. As in Saskatchewan, all credit unions in British Columbia were required to contribute to the fund (Schroeder, 1983). Between 1968 and 1988, the Credit Union Deposit Insurance Corporation (CUDIC) of British Columbia – which was overseen by CURB – provided unlimited deposit insurance for their members. However, financing unlimited deposit insurance was difficult since there was a valid concern among credit unions regarding liability and keeping the promise (Schroeder, 1983). To secure an explicit provincial backstop, the deposit guarantee was lowered to $100,000 in 1988, where it remained until 2008. For most of this period, the coverage exceeded the $60,000 of federal deposit insurance provided to the banks through CDIC. In 2008, the provincial government adopted unlimited deposit insurance coverage (Stevenson, 1993).

In Ontario, credit unions created their own stabilization scheme in 1961, although there is evidence that it was not mandatory. Later, the Credit Union League in that province demanded that the provincial government amend the legislation to allow the Credit Union League to investigate affiliated credit unions when concerns about their well-being arose, giving it some of the powers and responsibilities that were part of these stabilization entities elsewhere (Schroeder, 1983). Eventually, a more formal deposit insurance scheme was created in 1977 called the Ontario Share and Deposit Insurance Corporation (OSDIC).

In Quebec, the government became concerned about relinquishing control to the federal government through the CDIC (Schroeder, 1983). The province thus created the Quebec Deposit Insurance Board and, in 1967, a few months after the creation of the CDIC, delivered equivalent insurance coverage for all financial institutions in Quebec, including credit unions ((Schroeder, 1983). The coverage was set at $20,000—the same level as the CDIC. The creation of the Quebec Deposit Insurance Board ensured that the deposit insurance in Quebec for all provincially chartered financial institutions was homogenous (Schroeder, 1983). Unlike in most other provinces, the Desjardins continued to operate two stabilization funds, created in 1949, as part of the larger Desjardins system. In 1980, these funds were eventually merged into one entity, which continues to this day and is governed entirely within the Desjardins system.

In 1968, in Saskatchewan, the provincial government passed revisions to the *Credit Union Act*, opening the door for CDIC to play the role of a lender of last resort for the Mutual Aid Board; in 1973, this possibility became a reality when the federal government amended the CDIC Act to empower CDIC to make up to $250 million in loans to provincial stabilization funds and/or credit union centrals.[6] This legislative amendment was made at the behest of credit unions

[6] In Canada, each province had, until recently, its own credit union central. Several still do. Alberta, Saskatchewan, and Manitoba all still have their own centrals. In Ontario and British Columbia, credit unions own an entity called Central1, which was created in 2008 from a

(including Desjardins caisses), who recognized that the collapse of Atlantic Acceptance and Prudential Finance accentuated the perception that if a widespread crisis were to occur, there would be insufficient resources to make up for the losses (Schroeder, 1983). Credit unions, therefore, realized that further safeguard measures were needed and saw the CDIC lending facility as an important way of mitigating any future risks related to deposit runs either in a provincial credit union system or across provincial systems (Schroeder, 1983). Importantly, CDIC was not and still is not the provider of deposit insurance for Canadian credit unions (Mashkin, 2010); rather, deposit insurance is provided by provincial deposit guarantee corporations which, as noted, started out as stabilization funds (Schroeder, 1983).

3.5 Summary

The stability of the Canadian banking system, which was largely achieved through the periodic *Bank Act* revision, branch banking, and double liability, led to the relatively late emergence of deposit insurance. Different regulatory financial rules between federal and provincial governments led to the proliferation of provincial near-banks and credit unions (Kyer, 2017; Wagster, 2007). This proliferation caused policymakers to worry about the stability of the financial system; a concern exacerbated by the failure of Atlantic Acceptance Corporation, which convinced federal policymakers to adopt deposit insurance through the CDIC. Joining the CDIC was mandatory for federally regulated banks and voluntary for provincial trust companies. The CDIC provides deposit insurance for chartered banks and trust companies but not for credit unions (Wagster, 2007).

CDIC subsequently became a lender of last resort for credit unions. However, in Saskatchewan and British Columbia (and other provinces), stabilization funds for credit unions were established before the creation of the CDIC. These stabilization funds were focused on preventing financial crises in credit unions and in so doing, provided a form of deposit insurance (Schroeder, 1983); most of these stabilization entities would later be folded into more formal deposit insurance schemes following the creation of CDIC.

---

merger of the respective provincial centrals. Credit unions in the four Atlantic provinces are represented by Atlantic Central, also the result of a merger of previously independent provincial centrals. In Québec, the Desjardins caisses are members of the Fédération des caisses Desjardins du Québec, a central-like entity for that province. At the national level, credit unions (but not Desjardins caisses) own an entity called the Canadian Credit Union Association (CCUA), which provides advocacy and educational services but which in a previous incarnation, Credit Union Central of Canada (CUCC), also provided pan-Canadian payments and liquidity services.

Chapter 4: Literature Review

4.1 Introduction

To understand the incentives and dynamics of credit unions toward risk-taking, this literature review is divided into two sections. Section 4.2 reviews the literature on specific features of credit unions that may have an influence on their risk-taking. These features include common bonds, ownership structure, executive compensation structure, and market discipline. Section 4.3 reviews the literature on the relationship between deposit insurance and risk-taking behaviour both in banks and credit unions as there are similarities between the two financial institutions. This section also provides context regarding the relationship between deposit insurance and risk-taking behaviour in banks, which is relevant for understanding this study of deposit insurance in credit unions. Section 4.4 describes the research gap that this study attempts to address.

4.2 Features Influencing Risk-taking Behaviour in Credit Unions

4.2.1 Common Bond

Credit unions emerged as a place where individuals could save money and share the resulting funds, via loans, with other members. In other words, credit unions emerged in part at least, to facilitate access to credit for its members (Bauer, 2008). Credit unions were typically, but not always, based on some kind of common bond that would allow them to gauge borrowers' risk (Banerjee et al.,1994). The term *common bond* refers to the shared professional, cultural, religious interests or community ties of those who belong to a credit union (Stern et al., 2009). This common bond may help credit unions assess risk because community knowledge, such as unquantifiable 'soft information' about personality and reputation, can be used to assess the creditworthiness of loan applicants. Furthermore, the common bond has a bearing on the social capital that encourages the borrower to repay their loans (Kane & Handershott, 1996). A common bond allows credit unions to mitigate the problem of asymmetric information, which has always been present in banking when lending to a diverse client base (Ely, 2014).

Because of the benefit of soft information and social capital, credit unions were long believed to be in a better position to assess default risk than banks (Banerjee et al., 1994; McKillop & Wilson, 2011). However, this rationale does not hold today as most credit unions have grown in membership with their common bonds expanding to include a broader share of the community (Ferguson & McKillop, 1997). When the common bond is expanded, social capital can be compromised, thereby increasing risk (Ely, 2014; Karlan, 2007; Stiglizer, 1990).

Interestingly and, by contrast, a study conducted by Van Rijin (2018) has shown that, since expanded common bonds allow for more risk diversification, they may not lead to increased risk as predicted. Van Rijin (2018) applied a difference-in-difference methodology to examine whether credit unions' conversion from single or multiple community bonds to more expanded

common bonds decreased risks via risk diversification, or increased risk via reduction of social capital. Van Rijin (2018) demonstrated that risk is reduced for credit unions with expanded common bonds, concluding however, that it is difficult to determine why expanded common bonds reduce risk: was it the result of risk diversification of portfolio, or simply the result of a more capable manager.

From this study, it can be concluded that common bonds can have two contrasting effects on risk. On the one hand, common bonds can reduce risk via soft information and stronger social capital, which helps credit unions assess the risk of borrowers and reduces the risk of default. On the other hand, common bonds can lead to a lack of risk diversification, and subsequently, increased risk.

4.2.2 Ownership Structure

Differences in ownership structure can also influence risk-taking behaviour. The way in which the ownership structure of any corporation affects its risk-taking behaviour is described by agency problems (Jensen & Meckling, 1976). The agency problem refers to asymmetric information and the resultant change in behaviour that occurs when there is a conflict of interest among different parties involved and a person or group who has more information uses the information to take advantage of the other party (Jensen & Meckling, 1976). Credit unions, like banks, can have agency problems between the manager and owners (i.e., members), where managers may be interested in a self-serving, often higher risk, behaviour that does not align with the interests of owners (Wilcox, 2006).

However, the confluence of roles in credit unions, where members are both owners and customers, can mitigate some risk-taking behaviour (Challita, 2016). Unlike banks that have shareholder ownership structures, credit unions do not have shareholders who can buy and sell shares on stock exchanges (Naaman et al., 2021); thus, credit unions are not compelled to maximize profit for the benefit of shareholders as are banks, which mitigates the likelihood of credit unions' involvement in risky projects. Research has demonstrated this mitigation effect. Naaman et al. (2021) studied the difference in risk-taking among banks and credit unions from 2010 to 2017 by applying a matching sample based on the loan type, size, and country. They found that risk-taking tendencies are greater in banks than in credit unions.

4.2.3 Executive Compensation and the Role of the Board of Director

Credit unions also differ from banks in their executive compensation structure, which can influence managerial risk-taking behaviour. Since a credit union normally cannot tie manager compensation to share prices and they do not use stock options, managers' salary and bonus-based compensation may foster more prudent behaviour than in banks. Managers might have their compensation set in terms of objectives other than pure profitability (i.e., member service). This should help mitigate moral hazard (Challita, 2016; Dettmann & Cartwright, 2013; Rasmusen, 1988; Van Rijn et al., 2019).

However, a competing viewpoint is that credit union executives may engage in more risk-taking behaviour because they are not incentivized to reduce costs in the same way that banks are and they also have more opportunities to increase their personal compensation (DeYoung et al., 2016; Newton, 2015). Additionally, because credit unions function as co-operatives, they are controlled by the one-member-one-vote principle. This one-member, one-vote governance structure suggests that members suffer from a lack of concentrated voting power (Hillier et al., 2008; Ramusen, 1988). Reduced concentrated voting power means that credit union members have little incentive and capacity to monitor the executive compensations of their institution, so free-riding behaviour can be prevalent (Hillier et al., 2008; Ramusen, 1988). The diminished monitoring by members may provide more opportunities for credit union managers to report greater expenses, which increases the operational risk of credit unions (Ramusen, 1988).

Another feature of credit unions that may influence risk-taking behaviour is the board of directors. Credit unions boards are elected democratically by the membership. They therefore may not possess the required skills to perform the oversight job well. Consequently, this may inadvertently encourage risk-taking behaviour (Brannen & Ibrahim, 2010). In jurisdictions like the United States, credit union board members are not compensated financially for their work. Therefore, the board of directors may not be as motivated to monitor credit unions as the board of directors in more traditional financial institutions.

However, by law all boards are required to be prudent, diligent, and loyal (Brannen & Ibrahim, 2010) and in Canadian credit unions, it is normal for boards to be compensated. In British Columbia, credit union boards are required to take actions in the interests of their members and are accountable to the Financial Institution Commissions (FICOM). They are also compensated. Also, the provincial regulator assesses whether the board has the required skills and whether it serves the interest of members. From the literature review, I cannot conclusively determine whether credit union boards increase or decrease risk-taking behaviour.

4.2.4 Market Discipline

When deposit insurance is unavailable, market discipline exists in financial institutions. Depositors exercise market discipline for financial institutions--particularly those with risky assets or inadequate capital for compensation—by demanding higher interest rates on deposits. If depositors do not receive higher interest rates, they can exercise further discipline by threatening to withdraw their money (Aysan et al., 2017). Depositors have the capacity to exert market discipline since they are the main source of funding in the banking industry (Gomez-Biscarr et al., 2021). This is especially true in credit unions, where deposits are often the only source of funding (Gomez-Biscarr et al., 2021). All other things being equal, if a bank has to pay higher interests on deposits to address perceptions of risk, they will experience a decrease in profits. Therefore, banks' risk-taking behaviour can become costly, and these higher costs send a signal to the banks to reduce their risk-taking appetite (Arnold, 2016; Aysan et al., 2017; Karels & McClatchey, 1999).

In credit unions, asymmetric information may be mitigated. As credit union members and owners are the same, shifting risk between them makes little sense. In these cases, there may be less need for market discipline (Gomez-Biscarri et al., 2021). Additionally, studies show that credit union owners, as owners and depositors, have risk-averse attitudes in comparison to bank owners who are not depositors (Gomez-Biscarri et al., 2021). These aspects of credit unions are reiterated by Arnold et al. (2016), who show that market discipline is stronger in cooperative banks than in commercial banks.

It should be noted that differently sized depositors will exert different amounts of discipline. Traditionally, credit unions were focused on members and hence attracted depositors with small deposits and lower to middle income status. Banks, by contrast, tended to focus on wealthier and/or commercial clients. To the extent this remains true, credit union depositors may not have adequate incentives or the financial literacy to monitor and exercise discipline over their credit unions (Gomez-Biscarri et al., 2021). As some credit unions have grown over time however, they have attracted depositors who hold larger balances. These include other credit unions, businesses, and government deposits, particularly from the municipality, university, school, and hospital sectors (MUSH). Large depositors tend to more active in monitoring and exercising discipline in credit unions. If they perceive increased risk, they effectively demand higher interest rates by moving their money elsewhere or by simply not moving deposits into credit unions. Smaller depositors, on their own, have less power but if large depositors exit at sufficient scale, small depositors may imitate their behaviour albeit with some lag (Davenport & McDill, 2006). As a result, under some circumstances, small depositors can collectively exert influence on deposit prices by exiting credit unions or by refusing to bring in new deposits in their institutions (Gomez-Biscarri et al., 2021).

However, the question remains as to whether the potential for market discipline in credit unions actually influences risk-taking behaviour. Gomez-Biscarri et al. (2021) argue that market discipline is reduced in credit unions since depositors develop a sense of belonging as members. This belonging may lead to more lenient behaviour from the depositors and reduce the influence of market discipline (Gomez-Biscarri et al., 2021), particularly when depositors are unwilling to leave their credit union because the difference in interest rates among different financial institutions is meager (Amess & Howcroft, 2001).

The risk-taking behaviour of credit unions may however be constrained by the fact that while not as centrally structured as the caisse system in Quebec, there remains a degree of informal and formal monitoring through their Centrals. Historically, and even today, these centrals were seen as lenders of last resort to the credit union system and as a result, could exert some discipline over their behaviour.

4.3 Deposit Insurance and Risk-taking Behaviour among Banks and Credit Unions

4.3.1 Deposit Insurance as a Driver of Moral Hazard

Deposit insurance may incentivize banks to engage in riskier projects than they would otherwise. As mentioned, this engagement driven by deposit insurance is known as a moral

hazard. Merton's (1977) Merton's (1977) theoretical model shows that the value of deposit insurance for banks is enhanced if banks keep risky assets or increase leverage. Therefore, deposit insurers or their regulatory counterparts pay close attention to the riskiness of bank balance sheets. Wagster (2007) examined the risk-taking behaviour of Canadian banks and trust companies after the adoption of deposit insurance in 1967. He showed that deposit insurance increased the risk-taking behaviour among Canadian banks. Other scholars have found similar trends in other countries (Ioannidou & Penas, 2010; Karas, 2019).

4.3.2 The Influence of Financial and Institutional Environments

The financial climate has a bearing on how much deposit insurance influences banks' appetite for risk-taking. Anginer et al. (2014) compared the effect of deposit insurance on banking both during the financial crisis and non-crisis periods. The authors chose a sample of 96 countries and measured risk by applying the Z-score, a measure of bank resilience, and stock return volatility in different banks. They concluded that deposit insurance reduces risk-taking behaviour during an economic crisis, but during normal times, it increases risk-taking behaviour. They also showed that during the whole period of the study (including normal and crisis periods), deposit insurance increased instability overall because the instability during normal times was greater than the stability that deposit insurance brings during a crisis.

The institutional environment has also been shown to influence the relationship between deposit insurance and moral hazard. Demirguc-Kunt and Detragiache (2000) used panel data to study this relationship in 61 countries from 1980 to 1997 and found that deposit insurance diminished bank stability. They defined bank stability as the likelihood of a systemic banking crisis. They found that banking stability particularly diminished in fragile institutional settings. One explanation is that asymmetric information between management and shareholders plays a bigger role in fragile settings, which can be characterized by a lack of transparency and poor accounting system. Therefore, auditing cannot be conducted properly, and regulation cannot effectively mitigate the information asymmetry (Mashkin, 2010). Anginer et al. (2014) showed that the institutional environment, particularly aspects of supervision and regulation, can mitigate the problem of asymmetric information and reduce the negative side effects of deposit insurance. To measure the influence of bank supervision and regulation, the researchers used quality measures, as established in Barth et al. (2008), that indicated whether the supervisor has the authority to take preventative action such as replacing the manager when necessary. Anginer et al. (2014) concluded that, in normal times, supervision and regulation mitigate systemic risk as a result of deposit insurance. Angkinand and Wihlborg (2010) showed that an institutional environment that encourages monitoring alleviates the influence of deposit insurance on the risk-taking behaviour of banks.

4.3.3 The Influence of Deposit Insurance Coverage

The design of deposit insurance may also influence the moral hazard effect, as deposit insurance reduces market discipline to differing extents depending on the degree of coverage. Empirical studies show that when the deposit insurance does not cover the whole deposit, the moral hazard effects of deposit insurance can be mitigated. For example, research has shown that depositors with exposure to some amount of uninsured deposits reduce the risk-taking behaviour of banks (Diamond & Rajan, 2001; Maechler & Mcdill, 2006). Similarly, Ioannidou and Dreu (2006) studied the influence of deposit insurance on market discipline in Bolivia from 1998 to 2003, finding that the higher the coverage of deposit insurance, the weaker the market discipline. They demonstrated that when deposit insurance covers 60% of the deposit, market discipline declines sharply. When the coverage is 100%, no market discipline remains. Their results also showed that large depositors exert more market discipline than other depositors initially because coverage often does not include the entirety of large deposits. These results are supported by studies in different countries and different financial environments, all of which have found that large-scale depositors, when exposed to uninsured deposits, can reduce the risk-taking behaviour of banks (Demirguc-Kunt & Detragiache, 2000; Loannidou & Dreu, 2006). Lambert et al. (2017) studied the relationship between increased deposit insurance coverage and American banks' risk-taking behaviour. They compared banks with higher coverage to those with lower coverage, concluding that higher coverage of deposit insurance increases risk-taking behaviour, particularly when a bank's capital is small. Thus, the extent of coverage offered by deposit insurance impacts risk-taking behaviour and the resultant banking stability. Taken together, these results suggest that to avoid distorting the incentive for monitoring a financial institution, no depositor should be given full deposit insurance coverage.

Consistent with this finding, uninsured depositors have been shown to help reduce the moral hazard effects of deposit insurance on American savings and loans institutions (Goldberg & Hudgin, 1996). As savings and loans institutions resemble credit unions in important respects—such as size, some measure of democratic control, and regulatory oversight—these results may apply to credit unions as well. Goldberg and Hudgins (1996) found that as the share of uninsured deposits to total deposits increases at loans institutions, risk-taking behaviour decreases. They also found that uninsured deposits increase the monitoring incentives of financial institutions, which in turn reduce the moral hazard risk. Likewise, Dalsem (2017) found that uninsured deposits reduce risk-taking behaviour, particularly in small credit unions.

4.3.4 Deposit Insurance as a Non-driver of Moral Hazard

While many studies have found a positive association between deposit insurance and risk-taking behaviour, others have found no evidence of increased risk-taking; in some cases, deposit insurance actually led to a *reduction* in risk-taking behaviour. For example, Gropp and Vesala (2004) found that deposit insurance diminished risk-taking appetite in European

countries if non-deposit creditors were excluded from the deposit insurance coverage. By this exclusion, monitoring and consequently market discipline improved. In similar research on the influence of deposit insurance on Islamic banks in Turkey, Aysan et al. (2017) showed that risk-taking behaviour decreased after the implementation of deposit insurance. The business model of Islamic banks differs from conventional banks as Islamic banks are mainly run through contracts, similar to profit-sharing and joint ventures. Therefore, market discipline is stronger since the nature of the deposit is similar to equity. Gueyie and Lai (2002) examined the excessive risk-taking behaviour of Canadian banks after the introduction of deposit insurance in 1967; they found that the introduction of deposit insurance did not encourage moral hazard. Kariyasam (2020) studied 23 banks from 2008 to 2019 in Sri Lanka to understand whether the government-supported adoption of deposit insurance in 2012 encouraged excessive risk-taking behaviour. He found that the introduction of deposit insurance diminished overall risk-taking behaviour. Karels and McClatchy (1999) and Centeno and Petrick (2018) examined the effects of adopting deposit insurance in American credit unions and banks, respectively; they found that there was no increase in risk-taking behaviour.

Similar to my study, Atanasova et al. (2019) examined whether the policy change in deposit insurance coverage from $100,000 to unlimited in 2008, increased risk-taking behaviour among British Columbia credit unions. They use earning volatility, measured as net income (pre-tax) divided by risk-weighted assets, as a proxy for risk and compare the risk-taking behaviour in 107 British Columbia credit unions before and after the policy change. They also compare these results to those of a selection of Canadian banks, which did not experience any change in deposit insurance coverage over the period of analysis (1992 to 2014). Their analysis does not reveal any evidence that the policy change in British Columbia encouraged risk-taking behaviour among British Columbia credit unions; in fact, they find that this policy change decreased risk-taking behaviour as measured by earnings volatility. The authors point out that their preference would have been to conduct a difference-in-difference analysis with Ontario credit unions as the control group but were unable to access the needed Ontario data.

Chapter 5: Methodology

This chapter outlines the methods applied to test whether unlimited deposit insurance led to increased risk-taking behaviour in credit unions in British Columbia. It also provides an overview of the hypothesis development and a description of the data. To analyze if there were increased risk-taking behaviors amongst B.C. credit unions, I used two models in this study. First, I applied a difference-in-difference methodology (DID). Second, I used a comparative interrupted time series (CITS), which is an extension of DID.

5.1 Hypothesis for the DID

Although there is no empirical agreement on the influence of unlimited deposit insurance on risk-taking behaviour in the banking industry, theory predicts that the general effect of unlimited deposit insurance creates an increase in risk-taking behaviour. Thus, the objective of this study was to test if the policy change in British Columbia, which moved from $100,000 of deposit insurance coverage to unlimited deposit insurance coverage in 2008, increased the risk-taking behaviour of credit unions in this province.

H0: The introduction of unlimited deposit insurance for credit unions in British Columbia had no impact on their risk-taking behaviour.

Ha: The introduction of unlimited deposit insurance in British Columbia affected the risk-taking behaviour of credit unions in British Columbia. If H0 is rejected, then the conclusion will be that the policy change is associated with risk-taking behaviour.

If a statistically significant relationship between unlimited deposit insurance and risk-taking behaviour is found, the null hypothesis will be rejected and the alternative hypothesis – that the introduction of unlimited insurance affects risk-taking behaviour— will be accepted.

5.2 Description of Variables

To measure the influence of unlimited deposit insurance on risk-taking behaviour, I use the Z-score as a proxy for measuring risk-taking. The Z-score measures the credit unions' insolvency risk and is defined as the natural logarithm of (ROA+EQTA)/SDROA, where ROA represents the bank's profitability and ROA is defined as the ratio of net income to average total assets; EQTA is defined as total equity to total assets, and the SDROA stands for the standard deviation of ROA over the sample period (Kouassi et al., 2011, p 5). An increase in the Z-score indicates a lower probability of insolvency. Risk of insolvency occurs when the bank's losses are greater than its equity (Laeven & Levine, 2009). The Z-score is widely used to investigate risk-taking behaviour both in banks (Laeven & Levine, 2009; Lambert, 2017) and credit unions (Ely, 2014; Naaman, 2021). A higher Z-score is an indicator of higher stability and therefore can be used as a proxy to represent lower risk-taking behaviour (Laeven & Levine, 2009).

5.3 Data Description

This study acquired data for British Columbia and Ontario credit unions in aggregate from 1997 to 2018. The aggregate data was accessed from all credit unions balance sheets, income statements, and credit unions' capital requirements for each respective province collected by the Canadian Credit Union Association (CCUA). CCUA confirmed that the data was consistent through time (1997-2018).[7] Prior to 2008, CCUA only collected annualized fourth-quarter data. Subsequently, CCUA collected the same data quarterly. For consistency, this study used data obtained from the fourth quarter of every year for the period of study. To account for differences between two provinces that may have an influence on Z-score, I also included the provincial unemployment rate for British Columbia and Ontario; data for the unemployment rate were acquired from Statistics Canada.

5.4 Summary Statistics

Table 1 (below) presents the descriptive statistics (number of observations, means, standard deviations, minimums, and maximums) for the Z-scores by the provincial credit union system. There are 22 annual observations, from 1997 to 2018. The mean of the Z-score is relatively similar for credit unions in British Columbia and Ontario. The mean of the control variable, the provincial unemployment rate, is slightly higher in Ontario than in British Columbia.

Table 1-Descriptive Statistics

Variable	Obs.	Mean	Std. Dev	Min	Max
Z-score in ON	22	4.19	0.00	4.04	4.26
Z-score in BC	22	4.21	0.01	4.10	4.31
Unemployment rate in ON	22	7.01	0.20	5.70	9.20
Unemployment rate in BC	22	6.75	0.30	4.30	8.8

Note: ON stands for Ontario and BC stands for British Columbia

[7] CCUA noted that the data has remained consistent over time, suggesting that there were no meaningful structural changes that have risen from the introduction of the federal credit union option. Since 2012 some provincial credit unions have been able to continue their activity as a federal credit union; however, to date, only two credit unions have made the jump to federal jurisdiction, Uni Financial Cooperation (in 2016) and Coast Capital (in 2018).

Figure 1 compares the Z-scores for British Columbia and Ontario credit unions from 1997 to 2018. The Z-score in Ontario remained almost unchanged, whereas there was a slight increase in British Columbia over time. From 1997 to 2008, there was a parallel trend in the Z-score for credit unions in British Columbia and Ontario (see Figure 1). From 2008 to 2010, the Z-scores in both provinces was relatively similar— above 4.25. Between 2010 and 2018, the Z-score was slightly higher in British Columbia than in Ontario, indicating higher stability. Figure 1 shows that after the 2008 policy change to unlimited deposit insurance in British Columbia, the Z-score for credit unions was equal to or higher than that of Ontario. It appears that the policy change in British Columbia improved financial stability rather than increasing risk-taking behaviour.

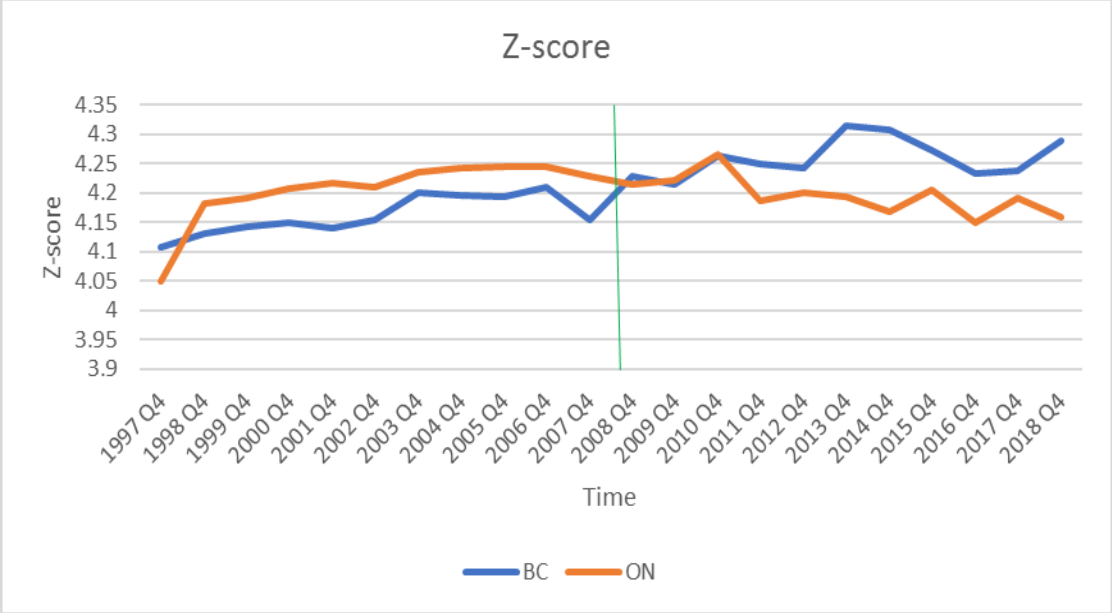

Figure 1-The Z-score

Note: the policy intervention in 2008 is shown by the green line.

5.5 Model Description for Policy Change Analysis (DID method)

To investigate the hypothesis, I began my analysis by employing the Difference-in-Difference (DID) model. In a DID model, the goal is to understand the impact of an intervention— for this study, a policy change. The policy change is the 2008 implementation of unlimited deposit insurance in credit unions in British Columbia. This province's policy change provides an opportunity to use the DID method to compare risk outcomes for credit unions in British Columbia and Ontario. Prior to 2008, credit unions in British Columbia and Ontario had identical deposit insurance coverage (i.e., $100,000). While British Columbia introduced unlimited deposit insurance for credit unions in 2008, Ontario did not. By comparing the risk outcome of

the two provinces, I can draw causal inferences between the policy change and credit unions' risk-taking behaviour.

If the policy change had a causal impact, it would be expected that British Columbia credit unions would have behaved differently after the intervention, while the behaviour of those in Ontario would have remained the same. In this study, if, after the policy change, the difference in the risk measurement (Z-score) of credit unions in the two provinces is statistically significant, the difference can reasonably be attributed to the policy change.

Using the DID design requires a control group and a treatment group for the pre-intervention and post-intervention periods. Because British Columbia changed its deposit insurance coverage from $100,000 to unlimited coverage, in 2008, its credit unions comprise the treatment group, while credit unions in Ontario are the control group. Credit unions in Ontario experienced the same financial instability from the global financial crisis as credit unions in British Columbia but kept their deposit insurance coverage at $100,000 until 2018. The control group (Ontario) is assigned the dummy variable 0, while the treatment group (British Columbia) is assigned the dummy variable 1. For pre- and post-policy intervention, the pre-intervention time is given a value of 0 and the post-intervention time is assigned a value of 1.

The main assumption of the DID model is that the trajectory of change for the treatment and control groups would have been the same if the treatment group had not been exposed to the change (Angist & Pischke, 2008). In other words, this study assumes that the relationship between risk taking in Ontario and British Columbia would have remained the same if unlimited deposit insurance coverage had *not* been implemented in British Columbia in 2008.

Figure 2 (below) illustrates the logic behind the DID model. The X-axis represents time, and the Y-axis represents the outcome of interest. As noted, I used the Z-score as a proxy for risk-taking behaviour (Y-axis). A higher z-score indicates less risk of insolvency. I did not use more conventional and better-known measures of credit risk, such as delinquency or loan-loss rates, because they violated the parallel trend assumption necessary for DID modeling. The blue line in Figure 2 shows the control group and the red line shows the treatment group. The control and treatment groups span the pre-intervention and post-intervention time periods. Because it is assumed that, before the intervention, the behaviour of the treatment and control groups would be similar to each other, there should be a parallel trend among the two groups in the pre-intervention period. However, the two lines should not necessarily lie on top of each other, as there may be differences between the treatment and control groups. Therefore, the control group and the treatment group may have different intercepts. β_1 shows the difference between the control and treatment groups before the intervention. For a better illustration, suppose in the pre-intervention period the average risk-taking behaviour in the control group is demonstrated by β_0 , and suppose that in the same period the average risk measure for the treatment group is $\beta_0 + \beta_1$. Therefore, the difference between the control group and the treatment group in pre-intervention period is β_1(Shahidur et al., 2010).

In the post-intervention period, the intercept for the treatment group increases by $\beta_2 + \beta_3$, whereas the control group increases only by β_2. I expected that in the absence of policy change, the treatment group would have behaved the same as the control group. I show this hypothetical behaviour with the counterfactual. By comparing the treatment group with counterfactual, I can assess the impact of the policy change. Since the treatment group increased by $\beta_2 + \beta_3$, while the increase in the control group was by β_2, therefore, β_3 represents the impact of the policy change, which is the policy impact (DID).

To calculate the value of the DID impact, I computed the average change over the pre- and post-intervention periods for both the treatment group (red line) and control group (blue line). From this, I then subtracted the average change for both groups. These yields β_3, the DID impact, as shown (the blue color stands for control and the red color shows the treatment group.

DID Impact = $((\beta_0 + \beta_2) - (\beta_0)) - ((\beta_0 + \beta_1 + \beta_2 + \beta_3) - (\beta_0 + \beta_1)) = \beta_3$

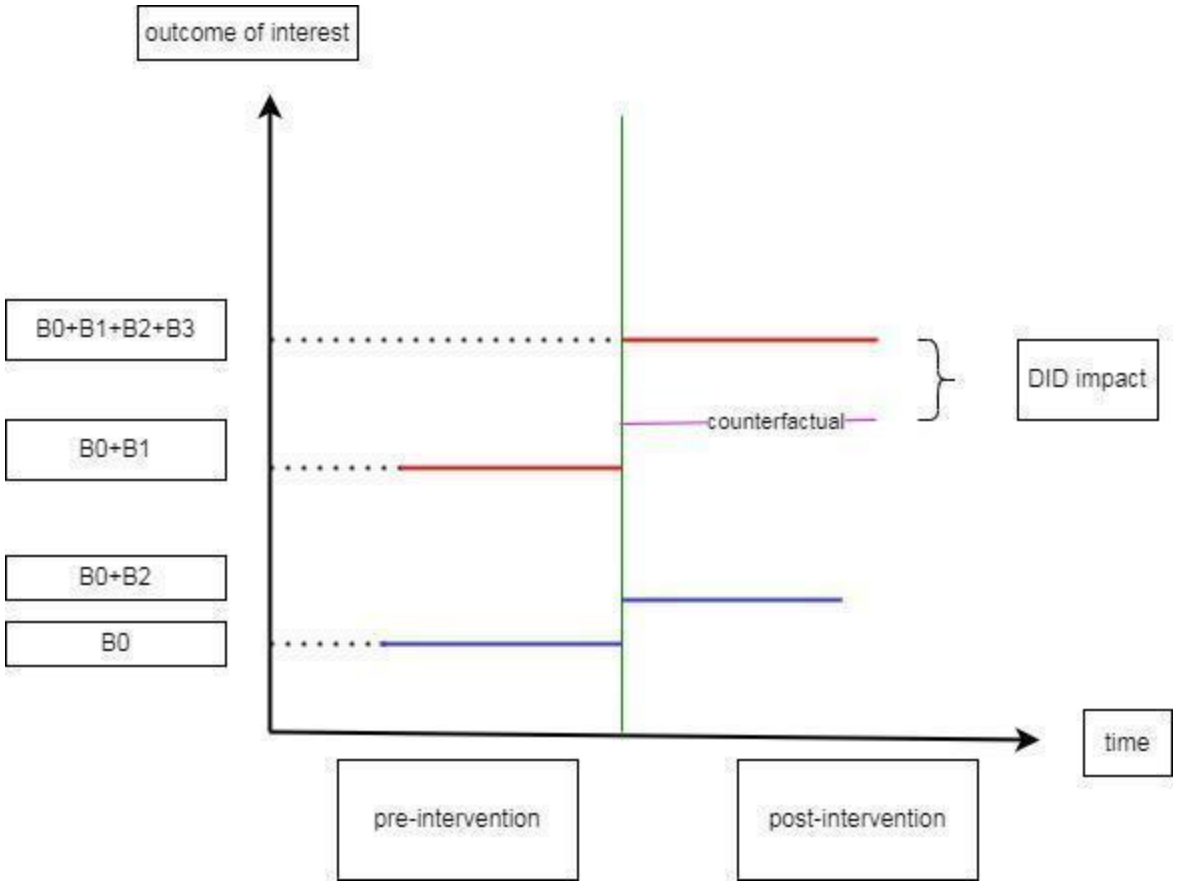

Figure 2- DID Model

5.5.1 Econometric Model for the DID

To calculate the impact of the policy change using the DID approach, this study uses the equation (1).

$$Risk_{it} = B_0 + B_1 G + B_2 P + B_3 GP + \epsilon_{it} \qquad (1)$$

$Risk_{it}$ shows the riskiness of the credit union system *i* at time period *t*, where *i* takes on values of Ontario or British Columbia. The variable *G* is a dummy variable for the treatment group; it takes on a value of zero for Ontario (the control group) and one for British Columbia (the treatment group). The variable *P* is a dummy variable for the policy intervention; it takes on a value of zero for the period prior to the change in policy in British Columbia and one for the period after. Finally, $\mathcal{E}_{it}$ is an error term that is assumed to hold the classic linear regression model assumption.

The parameter β_0 is an estimate of the average risk for the control group (Ontario) in the pre-intervention period. The estimate of the average risk for the treatment group (British Columbia) in the pre-intervention period is given by $\beta_0 + \beta_1$; thus, the parameter β_1 is the difference in

the estimated average risk between the control group (Ontario) and the treatment group (British Columbia) before the policy change.

The estimate of the average risk for the control group in the post-intervention period is given by $\beta_0 + \beta_2$, while the estimate of the average risk for the treatment group in the post-intervention period is $\beta_0 + \beta_1 + \beta_2 + \beta_3$. Thus, the difference in the estimated average risk between the control group (Ontario) and the treatment group (British Columbia) after the policy change is $(\beta_0 + \beta_1 + \beta_2 + \beta_3) - (\beta_0 + \beta_2) = \beta_1 + \beta_3$.

The difference in the average risk differential between the control group and the treatment group pre- and post-intervention is $(\beta_1 + \beta_3) - (\beta_1) = \beta_3$. Thus, β_3 provides an indication of whether the policy intervention has any impact on risk in the treatment group. If β_3 is statistically significant, then the null hypothesis— that the move to unlimited deposit insurance had no impact on risk— is rejected.

Table 2 shows the average Z-score for credit unions in British Columbia and Ontario. The Z-score for credit unions in British Columbia increased slightly after the policy change, while in Ontario the Z-score decreased slightly after British Columbia's policy change. The influence of policy change to unlimited deposit insurance in British Columbia was a 0.10% increase. Since a higher Z-score indicates a lower probability of default, I find no association between the adoption of unlimited deposit insurance in British Columbia and excessively risky behaviour as one would predict from a moral hazard perspective.

Table 2-Average Z-score for different treatment groups and different time periods

	1997-2007 (i.e., before 2008)	2008- 2018 (i.e., 2008 forward)	Difference- pre- and post-intervention
Ontario* (Control group)	**4.20**	**4.19**	**-0.01**
British Columbia (Treatment group)	**4.16**	**4.25**	**0.09**
Difference-BC-ON	**-0.04**	**0.06**	**0.10**
* Excludes credit unions affiliated with the Alliance network of Desjardins Caisses.			

5.5.2 Regression Results

Table 3 shows results of the difference-in-difference regression (equation 1). The results for the Z-score show that moving to unlimited deposit insurance policy decreased the credit unions' risk by 10%. Because a higher Z-score is indicative of higher bank stability, the positive sign of GP, which is an interaction of G and P, can be interpreted as an indicator for the reduction in risk-taking.

Table 3-Results of the DID Estimation

	Mean	Standard Deviation
Intercept	4.204***	0.0120
G	-0.042*	0.0169
P	-0.008	0.0169
GP	0.1066***	0.0240
Adj R2	0.42	

*Note: For p value, * shows p<0.05, ** shows p<0.01, and ** shows p <0.001*

The result of the regression (Table 3) must be consistent with the previous manual calculation of the DID table (Table 2). In Table 2, the average of the risk measures before and after the policy change were calculated for both treatment and control groups. From the regression, coefficient β_0 shows the average for the control group before policy change, and coefficient $\beta_0 + \beta_2$ shows the average for the control group after the policy change. Similarly, coefficient $\beta_0 + \beta_1$ shows the average for the treatment group before policy change, while the $\beta_0 + \beta_1 + \beta_2 + \beta_3$ shows the average for the treatment group after policy change. When the estimated coefficients ($\beta_0 + \beta_1 + \beta_2 + \beta_3$) were put into table 4, the results achieved were as expected, consistent with the prior manual calculation. To show these calculations more clearly, Table 4 presents and compares the results of the Z-score regression (Table 3) with the manual calculations in Table 2. Table 4 shows that I arrived at results identical to those presented in Table 2 (Program Evaluation, 2020). Note that because I only included 2 digits after the decimal point, the number in some cells is a close approximation to Table 2.

Table 4-Comparison of the Manual DID table (Table 2) with the DID Estimation (Table 3)

	Before policy change	After policy change	Difference
Control Group	RR: $\beta_0 = 4.20$	RR: $\beta_0 + \beta_2 = 4.19$;	$\beta_2 = 0.01$
	$T2$: 4.20	T2: 4.19	
Treatment group	RR : $\beta_0 + \beta_1 = 4.16$	RR: $\beta_0 + \beta_1 + \beta_2 + \beta_3 = 4.26$	$\beta_2 + \beta_3 =$ 0.10
	T2: 4.16	T2: 4.25	
Difference	$\beta_1 =$ -0.04	$\beta_1 + \beta_3 = 0.06$	β_3=DID impact= 0.10
Notes: RR = Regression Results from Table 3; T2 = Calculations from Table 2			

5.5.3 DID with Control Variables

To isolate the effect of British Columbia's policy change on risk-taking behaviour, I also included two control variables as set out in equation (2). To capture the provincial economic condition, I included the unemployment rate; to account for the financial crisis, I added a dummy variable that takes the value of one for the years 2007, 2008, and 2009, and the value of zero otherwise.

$$Risk_{it} = B_0 + B_1 G + B_2 P + B_3 GP + B_4 unem + B_5 crisis + \epsilon_{it} \qquad (2)$$

The result of equation (2) is shown in Table 5 and indicates that the introduction of unlimited deposit insurance has increased the Z-score by 9% for credit unions in British Columbia. The negative sign of the unemployment rate and financial crisis indicates that these variables increased the risk-taking of credit unions, although neither was statistically significant.

Table 5-DID Estimation with Control Variable

	Mean	Standard Deviation
Intercept	4.25***	0.03836
G	-0.393*	0.01720
P	-0.0039	0.01741
GP	0.0959***	0.02553
Unemployment Rate	-0.00074	0.00545
Crisis	-0.0061	0.01785
Adj R2	0.41	

Note: For p value, * shows p<0.05, ** shows p<0.01, and *** shows p <0.001.

5.5.4 Robustness Checks

To determine the robustness of the DID, I performed a placebo test. In this test, I shifted the time of policy change to an arbitrary time to verify whether the result was because of the policy change or the time trend. The results of the placebo test for all the years that I tested (from 2000 to 2013) were statistically significant, except for 2000, 2001, and 2002. However, it should be noted that for the years before the policy change, the results were only statistically significant at the 10% or 5% level, whereas the results for 2008 and the years after the policy change were statistically significant at the 1% level. Since the same results emerged when changing the time of the policy change, I acknowledge that I could not confirm the robustness of the DID estimation. One possible explanation for why the placebo test shows similar results is that DID does not allow me to capture the influence of time.

5.6 Comparative Interrupted Time Series (CITS)

To capture the influence of time, I also employed the Comparative Interrupted Time Series (CITS) model. CITS is similar to the DID, but the time dimension of data is included in this model. What distinguishes CITS from DID is that, while the benchmark for the DID is the deviation of the treatment group from the mean relative to the control group, the CITS also accounts for the trend. Accounting for the trend is important because what might be calculated as a difference between pre- and post- policy interventions might be because of the trend and not the

intervention policy (see Figure 3); additionally, CITS accounts for the fact that the control groups and comparison groups may have different trends (Somer et al., 2013). Another advantage of CITS compared to DID is that CITS could show the long-term effects of a policy change. This aspect of CITS is useful, as the effect of policy change may take time to manifest (Somer et al., 2013).

Because CITS involves a time dimension to the data, there is a tendency to violate the classic assumptions in econometrics (e.g., the Gauss Markov theorem). For example, the Gauss Markov theorem assumes that the error terms are independent of each other and there is no autocorrelation. This assumption will likely be violated when there is a time dimension, which might lead to incorrect inferences. Therefore, this study will use the Durbin-Watson test to examine whether there is autocorrelation.

Figure 3 (below) illustrates the logic behind the CITS model. The X-axis represents time, and the Y-axis represents the Z-score, which is a proxy for measuring risk-taking behaviour in this study. The control group is shown with a blue line and the treatment group is shown with a red line. Since there may be differences between the treatment and control groups, the two groups may have differences in intercept and slope.

In the pre-intervention period, the control group had an intercept of β_0 and a slope of β_4 while the treatment group in the same period had an intercept of $\beta_0 + \beta_1$ and a slope of $\beta_4 + \beta_5$. In the post-intervention period, the intercept and slope for the control group changed to $\beta_0 + \beta_2$ and $\beta_4 + \beta_6$ respectively. Without the policy intervention, I would expect the treatment group would have had the same trajectory as the control group. This hypothetical situation is shown by the counterfactual line, which provides a benchmark for what would have happened in the absence of the policy change. The inclusion of the control group helps the researcher to measure the counterfactual factor (Clair et al., 2016).

To capture the impact of the policy change, I compared the results of the treatment group with the counterfactual. The difference between the two accounts for the policy change. For example, because the change in level (intercept) for the control group is β_2, I expected that, in the absence of the policy change, the change in level for the treatment group would be the same. However, the change in level for the treatment group is $\beta_2 + \beta_3$. Therefore, I conclude that β_3 indicates the immediate impact of the policy change (change in level). Similarly, the change in slope for the control group is β_6, while the change for the treatment group is β_6+β_7; therefore, β_7 demonstrates whether the policy change had an impact on the trend (change in slope).

The CITS results are calculated by subtracting the intercepts and slopes after the policy change from the intercepts and slopes before the policy change for the control group and treatment groups separately, and then by subtracting the resultant calculation for each group from each other. In the CITS equation, the blue color shows the parameters related to the control group and the red color shows the treatment group. The result is as follows:

$$((\beta_0 + \beta_4 T) - (\beta_0 + \beta_2 + \beta_4 T + \beta_6 T)) - ((\beta_0 + \beta_1 + \beta_4 T + \beta_5 T) - (\beta_0 + \beta_1 + \beta_2 + \beta_3 + \beta_4 T + \beta_5 T + \beta_6 T + \beta_7 T)) = \beta_3 + \beta_7 T$$

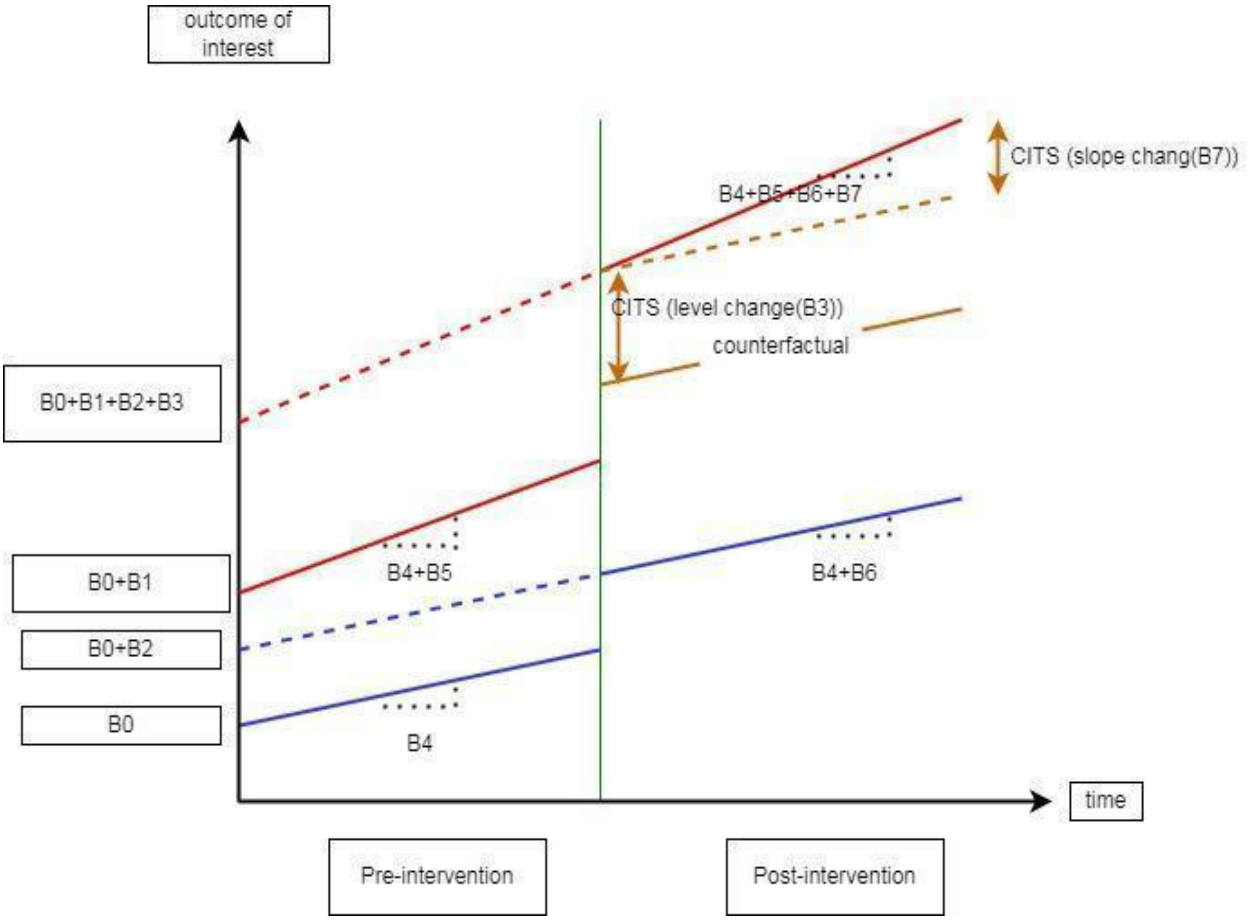

Figure 3- CITS Model

5.6.1 Empirical Model for the CITS

$$Risk_{it} = \beta_0 + \beta_1 G + \beta_2 P + \beta_3 GP + \beta_4 T + \beta_5 TG + \beta_6 TP + \beta_7 TPG + \varepsilon_{it} \quad (equation\ 3)$$

In equation (3), $Risk_{it}$ shows the riskiness of the credit union *i* at a time period *t*. T is the consecutive years of observation from 1 to 22 for both the treatment and the control group. P shows the policy change and takes the value of 0 before the policy change and 1 after the policy change for both groups. G takes the value of 0 for the control group and 1 for the treatment group. Parameter β_0 is the intercept for the control group. Parameter β_4 is the parameter associated with the trend for the control group. Parameter β_1 shows the difference between

the intercept of the control and treatment groups, and β_5 represents the difference between the trends of the control and treatment groups before the policy change. β_2 and β_6 show the changes in level and trend, respectively, for the control group after the policy change. Finally, the most important parameters of interest are $\beta_3$and β_7; β_3 compares the level change between the treatment and control group after the policy change, and β_7 shows how the trend changes among the two groups. If the policy intervention had an effect, then it would be evident from variables β_3 and β_7.

5.6.2 Hypothesis Test for CITS

The objective of using CITS is to test if the policy change in British Columbia from $100,000 deposit insurance to unlimited deposit insurance in 2008 increased the risk-taking behaviour of credit unions in this province by capturing *both* the impact of the change on the level and trend in risk taking. In the CITS model, I test the following joint hypothesis:

H_0: The introduction of unlimited deposit insurance for credit unions in British Columbia had no impact on the level (β_3), and trend (β_7) of their risk-taking behaviour.

H_a: The introduction of unlimited deposit insurance in British Columbia affected the risk-taking behaviour of credit unions in British Columbia. If H_0 is rejected, then the conclusion will be that the policy change has an influence on risk-taking behaviour.

$$H_0: \beta_3 = 0$$
$$\beta_7 = 0$$
$$H_a: \beta_3 \neq 0$$
$$\beta_7 \neq 0$$

The results of this hypothesis test shows that I can reject H_0 based on a joint test, F-statistic, whose value is 5.75, with a p-value of 0.006. I therefore conclude that the introduction of deposit insurance likely had some effect on the combined level and trend of risk for British Columbia credit unions. To identify whether the change took place in terms of a level (β_3) or trend (β_7) change and in what direction (more or less risk), I tested the following hypothesis:

1) $H_0: \beta_3 = 0$
   $H_a: \beta_3 \neq 0$
2) $H_0: \beta_7 = 0$
   $H_a: \beta_7 \neq 0$

5.6.3 CITS Result

In the CITS, the (β_3) is an indicator of a level change, while β_7 is an indicator of a change in trend. Table 6 shows the results of the CITS. From the p-value, the parameter related to level shift after the policy intervention (β_3) was not significant. Thus, I can conclude that the policy change did not affect the level of credit union risk-taking in British Columbia. The parameter related to trend change (β_7) was however significant. The sign of the coefficient suggests that the policy change reduced risk-taking behaviour by 0.01%. This result was consistent with the preliminary visualization of data in Figure 2 and the DID results.

Table 6-Analysis of Comparative Interrupted Time Series for Z-score

		Mean	Standard Error
β_0	The intercept of the control group before intervention	4.132***	0.0191
β_1	Difference between intercept of control and treated group before intervention	0.0111***	0.0026
β_2	the changes in level after the policy change for the control group	-0.0193***	0.0043
β_3	the level change between the intervention and control group (parameter of interest)	0.0459	(0.0380)
β_4	The trend of control value before intervention	-0.020	0.0275
β_5	Difference between the trend of control and treated group before intervention	-0.0099	0.0275
β_6	the change in trend after the policy change for the control group	-0.0032	0.0039
β_7	The difference in the trend changes between the two groups (parameter of interest)	0.0151*	0.0060
Adj R2	0.65		

Note: p value, * shows p<0.05, ** shows p<0.01, and *** shows p <0.001

5.6.4 CITS Result with Control Variable

As with the DID model, I also included control variables for the provincial unemployment rate and the financial crisis in the CITS model to better isolate the effect of the policy change. The sign of the coefficient for both the unemployment rate and the financial crisis show that they are associated with increased risk-taking behaviour, although only the financial crisis is statistically significant. Also, similar to the previous model, the variables of interest, β_3 and β_7, show that the policy change to unlimited deposit insurance did not encourage risk-taking behaviour.

Table 7-Analysis of Comparative Interrupted Time Series for Z-score with Control Variable

Parameter	Mean	Standard Error
β_0	4.1849***	0.4488
β_1	0.0143***	0.0025
β_2	-0.0283***	0.0046
β_3	0.0593	0.0341
β_4	0.0075	0.0282
β_5	0.0155	0.0306
β_6	-0.0076	0.0040
β_7	0.0194**	0.0060
unemployment rate	-0.0091	0.0059
crisis	-0.0538**	0.0150
Adjusted R Square	0.74	
F stats	12.88	

Note: p value, * shows p<0.05, ** shows p<0.01, and *** shows p <0.001

5.6.5 Diagnostic Test

To test for autocorrelation in the model, I performed the Durbin Watson Test. The results showed that the autocorrelation was not a problem since the estimation of Durbin Watson was near 2. The value 2 for the Durbin Watson Model represents no autocorrelation in the model. Since no autocorrelation was found, I stayed with the model. The results of the CITS model are consistent with the DID model, and both models indicate that introduction of unlimited deposit insurance decreased risk-taking behaviour of credit unions in British Columbia.

Table 8-Durbin Watson Test

	estimation	p-value
Durbin Watson Test	2.1288	0.205

5.7 Limitations

One of the constraints of this study was the shortage of data. For example, this study was limited because it had to focus on a small number of risk measures since some data (e.g., risk-weighted assets) were not available in the period before the policy intervention. Also, although this study initially considered using loan loss provision and loan delinquency as measures of risk taken by credit unions, I could not apply these risk measures for a DID or CITS analysis because there was no clear evidence of a parallel trend in the period leading up to the policy change.

Moreover, the result should be taken with the caveat that, for the DID and CITS methods to be valid and to be able to draw a causal inference, the policy change must be exogenous (Cameron & Trivedi, 2005). Due to the 2008 policy change in British Columbia, I cannot confidently say that the policy change was exogenous, as the change may have been made in response to the economic forces generated by the 2008 financial crisis. If the policy change was partly in response to the financial crisis, I cannot isolate the effect of policy; therefore, I cannot definitively conclude that the policy change had a causal effect. However, notably, almost all policies are implemented, at least in part, in response to a change in the economic, social, and health environments, and, in that sense, policy changes are never purely exogenous. According to Calomiris (2022), increases in deposit insurance coverage tend to occur when there are

recessions or banking crises. Also, I included a dummy variable in the models to capture the influence of the financial crisis.

One way to determine if there is exogeneity is by understanding the institution's arrangements. As both Ontario and British Columbia are in the same country and experience similar (but not identical) economic forces, I can conclude that the 2008 policy change in British Columbia was effectively exogenous. For example, credit unions in British Columbia were concerned that their deposits might flow to Alberta and credit unions in Ontario have long complained about deposit flow to Manitoba because both these neighboring provinces have and had unlimited deposit insurance and members of credit unions can transfer their money from a place with limited deposit insurance to the neighboring province with unlimited deposit insurance.

Additionally, to investigate whether policymakers implemented unlimited deposit insurance in British Columbia as a way to promote financial stability and increase the liquidity level in credit unions, I plotted and compared the ratio of retail deposits to total assets for credit unions in British Columbia and Ontario (see Figure 4). Figure 4 shows that the ratio of deposits to total assets for credit unions in British Columbia decreased slightly from 2005 to 2007, while it remained constant in Ontario. However, in the year prior to the policy change, this measure leveled off in credit unions in British Columbia. Also, this measure had other fluctuations both before and after the policy change in British Columbia. Therefore, it does not appear that policymakers decided to adopt unlimited deposit insurance in response to the liquidity level of credit unions in British Columbia.

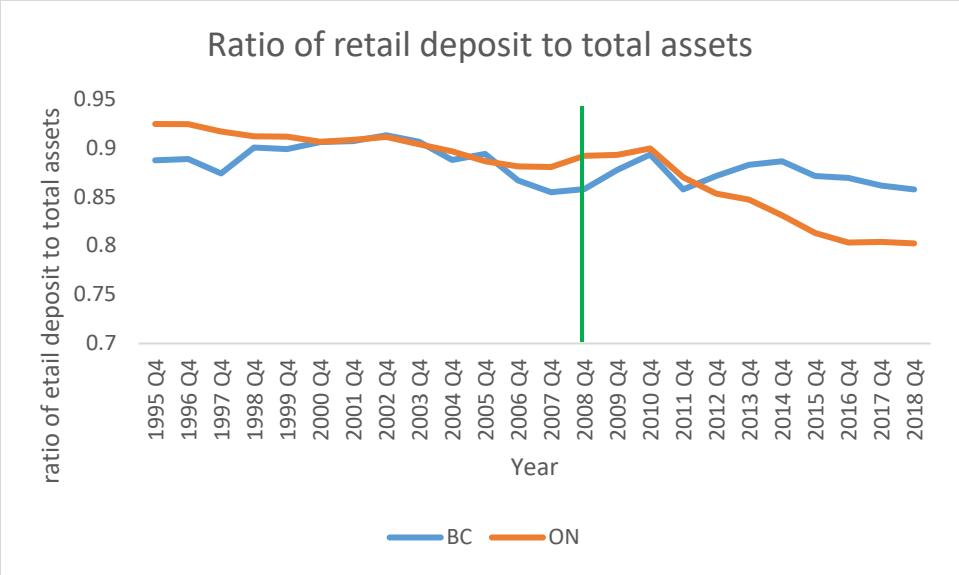

Figure 4-Ratio of retail deposit to total assets

Note: The policy intervention in 2008 is shown by the green line.

Finally, Figure 5 visualizes the ratio of loans to total assets to examine if credit unions in British Columbia were financially different than those of Ontario before 2008. As seen in Figure 5, I found no significant differences were found between credit unions in the two provinces, implying that the implementation of unlimited deposit insurance in British Columbia credit unions in 2008 was not in response to their different financial situations.

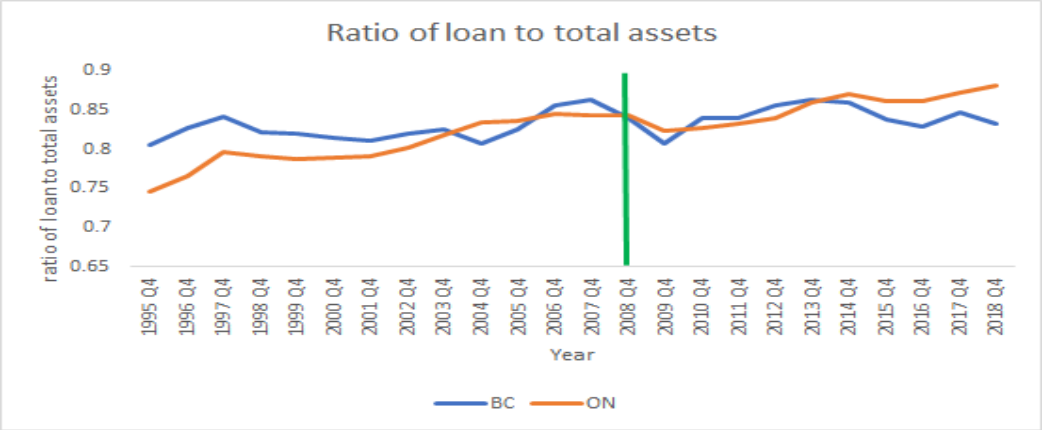

Figure 5-Ratio of loans to total assets

Note: the policy intervention in 2008 is shown by the green line.

Chapter 6: Policy Implications and Discussion

If adopting "unlimited" deposit insurance causes moral hazard consequences that outweigh the stabilizing effect, this could lead to systematic risk. When some banks engage in risky behavior, it would be irrational for other banks not to engage in similarly risky behavior (Farhi & Tirole, 2012). If they fail to do so, they will find themselves unable to compete with other banks whose balance sheets are risky; therefore, they get left behind. The result will be an increase in fragility and systemic risk (Farhi & Tirole, 2012).

Credit unions are an important part of Canada's intermediary financial institutions. They play a crucial role in the stability of the economy; therefore, determining the relationship between deposit insurance and risk-taking behavior can be helpful to understand if deposit insurance is a source of financial stability or financial instability in the economy. In the three Canadian provinces of British Columbia, Saskatchewan, and Manitoba, credit unions account for more than a third and up to half of the banking system's assets and customers (Canadian Credit Union Association, 2021). If credit unions engage in risky behavior, they may engender systematic financial risk for the economy.

In contrast to what theory generally predicts, my findings suggest that unlimited deposit insurance need not be associated with increased risk-taking. The resulting question is, why is this so? The statistical analysis does not answer this question. It does not tell us that the move to unlimited deposit insurance *caused* less risk; only that it is not associated with more risk. The historical perspective and literature review provide some ways to think about these findings and why I observe a lower risk profile for British Columbia credit unions after the introduction of unlimited deposit insurance.

First, the co-operative nature of credit unions means that executive compensation tends to be linked to performance – including member satisfaction – rather than mere profitability (Gomez-Biscarri et al., 2021). Moreover, even if credit union manager bonuses could be linked to high-risk lending, this mechanism lacks the immediacy or certainty of generating large windfall gains from exercising or selling stock options in an investor-owned, publicly-traded bank (Smith & Woodbury, 2010). The incentive towards risk is, in short, not as strong. Moreover, in credit unions, members and owners are the same people. Thus, taking excessive risk and shifting risk does not have quite the same incentive structure as it does in a publicly-traded bank (Gomez-Biscarri et al., 2021).

Second, the introduction of risk-based deposit insurance premiums alongside the move to unlimited deposit insurance may have dampened some of the incentive for risk taking that might have otherwise taken place (Atanasova et al., 2019). When a risk-based premium is in place, credit unions have an incentive to be more prudent compared to credit unions whose deposit insurance premium is set at a flat-rate. The premiums for risk-based deposit insurance are determined by the risk rating of credit unions. Regulators take the risk factors and on-site supervision of credit unions to their account and determine risk-based deposit insurance

premiums (Atanasova et al., 2019). Similarly, provincial regulators in British Columbia introduced strict new home-lending policies, modeled after OSFI's B-20 guideline, shortly after the introduction of deposit insurance. Again, this kind of regulatory intervention may have diminished the appetite, and ability, to take on higher-risk lending practices. It is also consistent with the fact that deposit insurance regulators, including in British Columbia, have a mandate to protect depositors and ultimately, the provincial government if it stands behind the deposit insurance guarantee. These policy changes may also have been motivated by the introduction of unlimited deposit insurance itself.

Chapter 7: Conclusion

This thesis has attempted to determine whether the policy change to unlimited deposit insurance has encouraged moral hazard in credit unions in British Columbia. Understanding the relationship between moral hazard and unlimited deposit insurance in credit unions is important because these institutions are a crucial provider of financial services in Canada. Theory predicts that unlimited deposit insurance increases the moral hazard problem. However, the very structure of credit unions as co-operatives, oriented primarily to serving members, could mitigate the moral hazard impact of deposit insurance, as could a competent regulator.

Very few studies have been conducted on credit union lending behaviours. Furthermore, this study makes a unique contribution by analyzing the effect of the policy change on unlimited deposit insurance in British Columbia. Both British Columbia and Ontario had the same deposit insurance coverage. Thus, when British Columbia changed its deposit insurance to unlimited while Ontario did not, this provided a unique opportunity for the semi-experimental method. For the methodology section, I included the comparative interrupted time series (CITS) model along with the difference-in- difference (DID) model. Although CITS and DID are similar, CITS is more robust and can capture the short- and long-term effect of policy change.

The results using the DID model provided no evidence that unlimited deposit insurance prompted increased risk-taking behaviour among credit unions in British Columbia. Indeed, the results showed that unlimited deposit insurance is associated with a decrease in risk-taking behaviour. The placebo test was conducted for robustness check in which the year of the policy test was arbitrarily changed. The result of the placebo test showed the same results for most years, indicating some lack of robustness in the model, indicating that I cannot be 100% sure that this reduced risk-taking behaviour is attributed to the policy change in unlimited deposit insurance.

To confirm that the DID results were correct, this study also uses the CITS. The CITS model captures changes in both levels and trends. The results of this model indicated that the policy change to unlimited deposit insurance did not influence short-term risk-taking behaviour. However, it was found that the policy change reduced the trend in risk-taking behaviour. This result was consistent with those of the DID approach.

Notably, these results contradict the standard theoretical prediction. While there are invariably challenges with this kind of empirical analysis, the findings of this study suggest that policymakers would be wise to abandon the line of thought that automatically equates unlimited deposit insurance with moral hazard. This study's results suggest that these theorized impacts may be mitigated and even reversed by the co-operative structure of credit unions and by what regulators themselves do.

References

Amess, K., & Howcroft, B. (2001). Corporate governance structures and the comparative advantage of credit unions. *Corporate Governance: An International Review, 9*(1), 59-65. https://doi-org.cyber.usask.ca/10.1111/1467-8683.00226

Anginer, D., & Demirgüç-Kunt, A. (2018). Bank runs and moral hazard: A review of deposit insurance. *World Bank Policy Research Working Paper*, (8589). https://openknowledge.worldbank.org/handle/10986/30444

Anginer, D., Demirguc-Kunt, A, & Zhu, M. (2014). How does deposit insurance affect bank risk? Evidence from the recent crisis. *Journal of Banking & Finance*, *48*, 312-321. https://doi.org/10.1016/j.jbankfin.2013.09.013

Angkinand, A, & Wihlborg, C. (2010). Deposit insurance coverage, ownership, and banks' risk-taking in emerging markets. *Journal of International Money and Finance, 29*(2), 252-274. https://doi.org/10.1016/j.jimonfin.2009.08.001

Angrist, J., & Pischke, J. (2009). *Mostly harmless econometrics: An empiricist's companion*. Princeton University Press.

Armour, J.A. (2018). Bank governance. in J.N. Gordon and W.G. Ringe (eds.), *The Oxford handbook of corporate Law and governance,* Oxford University Press.

Arnold, G, I., & Koziol, P. (2016). Market discipline across bank governance models: Empirical evidence from German depositors. *The Quarterly Review of Economics and Finance, 61*, 126–138. https://doi.org/10.1016/j.qref.2015.12.002

Atanasova, Li, M., Mugerman, Y., & Rastan, M. (2019). Government guarantees and the risk-taking of financial institutions: Evidence from a regulatory experiment. *Journal of Asset Management, 20*(6), 476–492. https://doi.org/10.1057/s41260-019-00128-2

Aysan, A., Disli, M., Duygun, M., & Ozturk, H. (2017). Islamic banks, deposit insurance reform, and market discipline: Evidence from a natural framework. *Journal of Financial Services Research, 51*(2), 257-282. https://doi.org/10.1007/s10693-016-0248-z

Banerjee, A., Besley, T., & Guinnane, T. (1994). Thy neighbor's keeper: The design of a credit cooperative with theory and a test. *The Quarterly Journal of Economics,*

*109 (*2), 491-515. https://academic.oup.com/qje/article-abstract/109/2/491/1870350?redirectedFrom=fulltext

Barth, J., G. Gaprio, & R. Levine. (2008). Bank regulation and supervision database: What works best? *Journal of Financial Intermediation 13*(2004), 205- 248. https://webhome.auburn.edu/~barthjr/papers/bank%20regulation.pdf

Bauer. (2008). Detecting abnormal credit union performance. *Journal of Banking & Finance, 32*(4), 573–586. https://doi.org/10.1016/j.jbankfin.2007.04.022

Beckhart, B. H., Cann, H. V., & Elliott, J. C. (1929). *The banking system of Canada* (p. 413). Henry Holt.

Brannen, D.E., & Ibrahim, N.A. (2010). The role and level of involvement of credit union directors in strategic management: A research agenda. International Journal of Management, 27, 680-692. http://cyber.usask.ca/login?url=https://www.proquest.com/scholarly-journals/role-level-involvement-credit-union-directors/docview/763170121/se-2?accountid=14739

British Columbia. (2018, March). Ministry of Finance. Financial Institution Act and Credit Union Institution Act review. Financial Institutions Act & Credit Union Incorporation Act review: preliminary recommendations (leg.bc.ca)

Calomiris, C., & Chen, S. (2022). The spread of deposit insurance and the global rise in bank asset risk since the 1970s. *Journal of Financial Intermediation, 49,* 100881. https://doi.org/10.1016/j.jfi.2020.100881

Calomiris, C., & Haber, S. (2014). *Fragile by design: The political origins of banking crises and scarce credit*. Princeton University Press.

Calomiris, C., & Kahn, C. (1991). The role of demandable debt in structuring optimal banking arrangements. *The American Economic Review, 81*(3), 497-513. https://www.jstor.org/stable/2006515

Cameron, A. C., & Trivedi, P. K. (2005). *Microeconometrics: Methods and applications.* Cambridge University Press.

Canadian Bankers Association. (2015). Review of the British Columbia Financial Institution Act and Credit Union Incorporation Act. Submission to the Ministry of

Finance https://www2.gov.bc.ca/assets/gov/employment-business-and-economic-development/fia-cuia-consultation/canadian-bankers-association.pdf

Canadian Credit Union Association. (2021, March 2). *Community and economic impact report*. Retrieved from: https://ccua.com/app/uploads/private-files/2020_CEIR_NationalEnglish_F.pdf

Canadian Credit Union Association. (2020). Annual Report. https://ccua.com/app/uploads/private-files/2021_CCUA_AGM2020AnnualReport_Final.pdf

Carr, J., Mathewson, F., & Quigley, N. (1995). Stability in the absence of deposit insurance: The Canadian banking system, 1890-1966. *Journal of Money, Credit and Banking, 27*(4), 1137-1158. https://doi.org/10.2307/2077794

Centeno, C.L & Petricek, M. (2018). Deposit insurance and bank risk-taking, a dynamic economic and monetary union, *ADEMU working paper series*. http://ademu-project.eu/wp-content/uploads/2018/06/101-Deposit-insurance-and-bank-risk-taking.pdf

Challita, S. (2016). *Impact of ownership structure on marketing strategies and on financial performances and risk: A multispectral approach*. Economics and Finance. Doctoral Thesis, Université Montpellier. https://www.researchgate.net/publication/319537589_Impact_of_ownership_strucutre_on_marketing_strategies_and_on_financial_performances_and_risk_A_multisectoral_approach

Cihák, & Hesse, H. (2007). Cooperative banks and financial stability. *IMF Working Paper, 7*(2). https://doi.org/10.5089/9781451865660.001

Clair, T., Hallberg, K., & Cook, T. D. (2016). The validity and precision of the comparative interrupted time-series design: Three within-study comparisons. *Journal of Educational and Behavioral Statistics, 41*(3), 269–299. https://doi.org/10.3102/1076998616636854

Cooper, R., & Ross, T. (2002). Bank runs: deposit insurance and capital requirement. *International Economic Review, 43*(1), 55-72. https://www.jstor.org/stable/827056

Dalsem, V., S. (2017). Uninsured deposits and excess share insurance at US credit unions: the impact on risk and returns to members. *Journal of Economics and Finance, 41* (4), 714–738. https://doi.org/10.1007/s12197-016-9376-4

Davenport, A.M., & McDill, K. M. (2006). The depositors behind the discipline: A micro-level case study of Hamilton Bank. *Journal of Financial Services Research, 30* (1), 93-109. https://doi-org.cyber.usask.ca/10.1007/s10693-006-8741-4

Deller, S., & Sundaram-Stukel, R. (2012). Spatial patterns in the location decisions of US credit unions. *The Annals of Regional Science, 49*(2), 417-445. https://doi.org/10.1007/s00168-011-0457-

Demirgüç-Kunt, A., & Detragiache, E. (2000). Does deposit insurance increase banking system stability? *Journal of Monetary Economics, 49*(7), 1373-1406. https://ideas.repec.org/a/eee/moneco/v49y2002i7p1373-1406.html

Dettmann, S., & Cartwright B. (2013). *CUES executive compensation survey executive summary.* http://www.cues.org/repository/ExecSummaryFinal-2013.pdf

DeYoung, R, Goddard, J, McKillop, D. G, & Wilson, J O. S. (2016.). Who consumes the credit union tax subsidy? *Queen's Management School Research Series*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3429208

Diamond, D. W., & Rajan, R., G. (2001). Liquidity risk, liquidity creation, and financial fragility: A theory of banking. *Journal of Political Economy, 109*(2), 287-327. https://ideas.repec.org/a/ucp/jpolec/v109y2001i2p287-327.html

Diamond, D.W., & Dybvig, P.H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy, 91*, 401-419. https://ideas.repec.org/a/ucp/jpolec/v91y1983i3p401-19.html

Dingle, J, F,. (2003). The bank failures of September 1985. Planning an evolution: the story of the Canadian Payments Association, 1980-2002. Bank of Canada. https://www.bankofcanada.ca/wp-content/uploads/2010/07/dingle_book.pdf

Drake, L., & Llewellyn, D. T. (2001). The economics of mutuality: A perspective on UK building societies. doi: 1004324/9780203470

Ely, D. (2014). Credit unions and risk. *Journal of Regulatory Economics*, *46*(1), 80-111. https://link.springer.com/content/pdf/10.1007/s11149-013-9241-8.pdf

Farhi, E., & Tirole, J. (2012). Collective moral hazard, maturity mismatch, and systemic bailouts, *The American economic review, 102*(1), 60-93. *https://www.aeaweb.org/articles?id=10.1257/aer.102.1.60*

Ferguson, C., & McKillop, D.G. (1997). The strategic development of credit unions. Wiley.

Freedman, C. (1998). The Canadian banking system. *Technical Report Bank of Canada.* https://www.bankofcanada.ca/wp-content/uploads/2010/01/tr81.pdf

Goldberg, L., & Hudgins., S. (1996) Response of uninsured depositors to impending S&L failures: Evidence of depositor discipline. *Quarterly Review of Economics and Finance, 36*(3), 311–325. https://go.gale.com/ps/i.do?id=GALE%7CA18955881&sid=googleScholar&v=2.1&it=r&linkaccess=abs&issn=10629769&p=AONE&sw=w&userGroupName=anon%7Ec51fce82.

Gómez-Biscarri, J., López-Espinosa, G., & Mesa-Toro, A. (2021). Drivers of depositor discipline in credit unions. *Annals of Public and Cooperative Economics.* https://doi.org/10.1111/apce.12352

Grodecka, & Kotidis, A. (2016). Double liability in a branch banking system: Historical evidence from Canada. *Sveriges Risksbank Working Paper Series, 319*. https://doi.org/10.2139/ssrn.2780411

Gropp, R., & Vesala, J. (2004). Deposit Insurance, moral hazard, and market monitoring. *Review of Finance, 8*(4), 571-602. https://www.ecb.europa.eu/pub/pdf/scpwps/ecbwp302.pdf

Gueyie, J., & Lai, V. (2003). Bank moral hazard and the introduction of official deposit insurance in Canada. *International Review of Economics & Finance, 12(*2), 247-273. https://www.researchgate.net/publication/222542466_Bank_Moral_Hazard_and_the_Introduction_of_Official_Deposit_Insurance_in_Canada.

Hillier, D., Hodgson, A., Stevenson-Clark, P., & Lhaopadchan, S. (2008). Accounting window dressing and template regulation: A case study of the Australian credit union industry. *Journal of Business Ethics, 83*(3), 579–593. https://economics.mit.edu/files/750

Hoel, R, F,. (2011). Power and governance: who really owns credit unions. Filene https://www.utahscreditunions.org/vendors/images/244_Hoel_Power_Governance.pdf

International Monetary Fund (2014). Canada financial sector stability assessment. *IMF Country Report 14*(29).

https://www.elibrary.imf.org/view/journals/002/2014/029/002.2014.issue-029-en.xml

Ioannidou, V. P., & Penas, M. F. (2010). Deposit insurance and bank risk-taking: Evidence from internal loan ratings. *Journal of Financial Intermediation, 19*(1), 95–115. https://doi.org/10.1016/j.jfi.2009.01.002

Ioannidou, V.P & Dreu, J. (2006). The impact of explicit deposit insurance on market discipline. *Netherlands Central Bank, Research Department*. https://doi.org/10.1016/B978-0-12-815859-3.00026-3

Ipsos. (2018). *Ipsos awards top honours for financial services excellence in Canada.* https://www.ipsos.com/en-ca/news-polls/ipsos-awards-top-honours-financial-services-excellence-canada

Jensen, M., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Kane, E., & Hendershott, R. (1996). The federal deposit insurance fund that didn't put a bite on U.S. taxpayers. *Journal of Banking & Finance, 20*(8), 1305-1327. https://doi.org/10.1016/0378-4266(96)00027-1

Karas, A., Pyle, W, & Schoors. K. (2019). Deposit insurance, market discipline and bank risk. *BOFIT Discussion Papers*, *2019*(10), 1-25. https://www.semanticscholar.org/paper/Deposit-Insurance%2C-Market-Discipline-and-Bank-Risk-Karas-Pyle/fbd0516244d6f8dc7f50025055a616e6fa50f2ef

Karels, G., & Mcclatchey, C. (1999). Deposit insurance and risk-taking behavior in the credit union industry. *Journal of Banking and Finance, 23*(1), 105-134. https://doi.org/10.1016/S0378-4266(98)00074-0

Kariyawasam, T. (2020). *Impact of deposit insurance on bank risk taking: Evidence from Sri Lanka.* Master`s Thesis, University of Queensland.

Karlan. (2007). Social connections and group banking. *The Economic Journal, 117*(517), 52–84. https://doi.org/10.1111/j.1468-0297.2007.02015.x

Kobrak, C., & Martin, J. (2018). *From Wall Street to Bay Street:* The origins and evolution of American and Canadian finance. University of Toronto Press.

Kouassi, T., Distinguin, I., &Tarazi, A. (2011). Bank deposit insurance, moral hazard market discipline: Evidence from Central and Eastern Europe. *SSRN Electronic Journal. http://dx.org/1002139/ssrn.1830265.*

Krugman, P. (2009). The return of depression economics and the crisis of 2008. New York: W.W. Norton.

Kyer, C. (2017). From next best to world Class: The people and events that have shaped the Canada Deposit Insurance Corporation 1967-2017. DIC. https://www.cdic.ca/wp-content/uploads/from-next-best-to-world-class-book.pdf

Laeven, L, & Levine. L. (2009). Bank governance, regulation and risk Taking. *Journal of financial economics, 93(*2), 259–275. https://doi.org/10.1016/j.jfineco.2008.09.003

Lambert, Noth, F., & Schüwer, U. (2017). How do insured deposits affect bank risk? Evidence from the 2008 Emergency Economic Stabilization Act. *Journal of Financial Intermediation, 29*, 81–102. https://doi.org/10.1016/j.jfi.2015.07.001

Llewellyn, D, & Holmes, M. (1991). In defense of mutuality: A redress to an emerging conventional wisdom. *Annals of Public and Cooperative Economics, 62*(3), 319-354. https://doi.org/10.1111/j.1467-8292.1991.tb01490.x

MacGregor, K. R. (February 12, 1966). Some won`t make the grade. *Financial Post, 60*, 6.

Maechler, A., & Mcdill, K. (2006). Dynamic depositor discipline in US banks. *Journal of Banking and Finance, 30*(7), 1871-1898. https://doi.org/10.1016/j.jbankfin.2005.07.010

McKillop, & Wilson, J. O. (2011). Credit unions: A theoretical and empirical overview. *Financial Markets, Institutions & Instruments, 20*(3), 79–123. https://doi.org/10.1111/j.1468-0416.2011.00166.x

Merton. (1977). An analytic derivation of the cost of deposit insurance and loan guarantees an application of modern option pricing theory. *Journal of Banking & Finance, 1*(1), 3–11. https://doi.org/10.1016/0378-4266(77)90015-2

Mishkin, F. (2007). *The economics of money, banking, and financial markets.* Pearson.

Naaman, C., Magnan, M., Hammami, A., & Yao, L. (2021). Credit unions vs. commercial banks, who takes more risk? *Research in International Business and Finance, 55*. https://doi.org/10.1016/j.ribaf.2020.101340

Newton, A, N. (2015). Executive compensation, organizational performance, and governance quality in the absence of owners. *Journal of Corporate Finance, 30*, 195-222. https://doi.org/10.1016/j.jcorpfin.2014.12.016

Ngalawa, H, Tchana, F, & Viegi, N. (2016). Banking instability and deposit insurance: The role of moral hazard. *Journal of Applied Economics, 19*(2), 323-350. https://www.tandfonline.com/doi/abs/10.1016/S1514-0326%2816%2930013-7

Poschmann, F. (2014, February). Shareholder liability: a new (old) way of thinking about financial regulation. *Commentary C.D .Howe Institute,* (401), 28. http://cyber.usask.ca/login?url=https://www.proquest.com/docview/1503674643?accountid=14739

Program Evaluation. (2020, October 6). *Difference-in-differences*. https://evalf20.classes.andrewheiss.com/example/diff-in-diff/

Rasmusen, E. (1988). Mutual banks and stock banks. *The Journal of Law and Economics, 31*(2), 395–421. Mutual Banks and Stock Banks on JSTOR

Savage, L. (2014). From trial to triumph: How Canada's past financial crises helped shape a superior regulatory system. *SPP research papers, 7(*15), 1-59. https://journalhosting.ucalgary.ca/index.php/sppp/article/view/42467/30359

Schroeder, D. (1983). Deposits fully guaranteed: A history of Saskatchewan's Credit Union Mutual Aid Board, 1953-1983. *Co-operatives Studies Collection*. Credit Union Central of Saskatchewan.

Shahidur R. K, Gayatri B, K, & Hussain A, S. (2010). *Handbook on impact evaluation: Quantitative methods and practices*. World Bank.

Smith, D., & Woodbury, S. (2010, May). Withstanding a financial firestorm: Credit Union vs. Banks. Filene Research Institute. Research Brief Withstanding a Financial Firestorm: Credit Unions vs. Banks | Filene Research Institute

Somer, M., Zhu, P., Jacop, R., & Bloom H. (2013). The validity and precision of the comparative interrupted time series design and the difference-in-difference design in educational evaluation. *MDRC working paper on research methodology.* https://www.mdrc.org/sites/default/files/validity_precision_comparative_interrupted_time_series_design.pdf

Staley., R. (2006, March). Enterprise the voice of Canadian Credit Unions. *Credit Union Central of British Columbia, 66*(2). https://dms.ccua.com/index.php/s/TC28eKLe8M9NFFa#pdfviewer

Stern, L., Swidler, V., & Hinkelmann, S. (2009). Deposit rate sensitivity of credit union shares. *Journal of Economics and Finance, 33*(3), 259-272. https://doi.org/10.1007/s12197-008-9028-4

Stevenson., G (1989, March/ April). Enterprise a credit union magazine. *Credit Union Central of British Columbia 49*(2). https://dms.ccua.com/index.php/s/TK6nyegCTaQS9Y5#pdfviewer

Stevenson., G (1993). Enterprise a credit union magazine. *Credit Union Central of British Columbia 53*(2). https://dms.ccua.com/index.php/s/YLaNr4dcaxcWNfq#pdfviewer

Stiglitz, J. (1990). Peer monitoring and credit markets. *The World Bank Economic Review*, *4(*3), 351-366. https://instruct.uwo.ca/geog/9322/StiglitzPMCR.pdf.

The Credit Union Deposit Insurance Corporation of Saskatchewan. (2020). https://www.cudgc.sk.ca/about-us/.

Tokle, R., Fullerton, T., & Walke, A. (2015). Credit union loan rate determinants following the 2008 financial crisis. *The Social Science Journal*, *52*(3), 364-373. https://www.tandfonline.com/doi/citedby/10.1016/j.soscij.2014.11.001?scroll=top&needAccess=true.

Van Rijn, J. (2018). The Effect of Membership Expansion on Credit Union Risk and Returns, *Agricultural and Applied Economics Staff Paper No 588.* University of Wisconsin*. https://api.aae.wisc.edu/pubs/pdf/sps/stpap588.pdf*

Van Rijn, J., Zeng, S., & Hueth, B. (2019). Do credit unions have distinct objectives? Evidence from executive compensation structures. *Ann Public Coop Econ, 1-34. http://doi.org/10.1111/apec.12365.*

Varian, H. R. (2010), *Intermediate microeconomics: A modern approach* (8th edition). W. W. Norton & Co.

Wagster, J. (2007). Wealth and risk effects of adopting deposit insurance in Canada: Evidence of risk shifting by banks and trust companies. *Journal of Money, Credit*

and Banking, 39(7), 1651-1681. https://doi.org/10.1111/j.1538-4616.2007.00082.x.

Wilcox, James A. (2006). Performance divergence of large and small credit unions. *Federal Reserve Bank of San Francisco, Economic Letter, 2006*(19). https://www.frbsf.org/economic-research/publications/economic-letter/2006/august/performance-divergence-of-large-and-small-credit-unions/).

World Council of Credit Union. (2020). Statistical report. *The Global Network of Credit Unions and Financial Cooperatives*.