Deposit Insurance Design and Credit Union Risk*

CHRISTINA ATANASOVA†, MINGXIN LI‡and MEHRDAD RASTAN§

August 2016

Abstract

Using data for 107 Canadian credit unions for the period April 1992 to December 2014, this paper analyzes the impact of changes in deposit insurance on earnings uncertainty. In particular, we examine the 2008 amendment to the Financial Institutions Act that involves two changes to the existing deposit insurance program: (1) the introduction of unlimited deposit insurance protection; and (2) the implementation of risk-based insurance premium. We find that the policy change decreased the annualized conditional volatility of the return on risk-weighted assets, spurred deposit growth and encouraged credit unions to increase their capital-to-asset ratio. Our results support the hypothesis that an increase in insurance coverage boosts depositors' confidence, and a risk-based premium mitigates moral hazard. The effect of the policy was stronger for small unions, those with low leverage, and lower systemic importance.

JEL Classification: G21; G28; L31; G22

Keywords: Deposit insurance; Financial cooperatives; Earnings volatility

---

*We would like to thank the Financial Institutions Commission for providing the data and their support for this research.

†Atanasova: Beedie School of Business, Simon Fraser University. E-mail: cva3@sfu.ca.

‡Li: Beedie School of Business, Simon Fraser University. E-mail: mla70@sfu.ca.

§Rastan: Financial Institutions Commission, 2800-555 West Hastings Street, Vancouver, BC V6B 4N6, Canada. E-mail: Mehrdad.Rastan@ficombc.ca.

1 Introduction

The popularity of deposit insurance among regulators and policy makers around the world is based on the widely held view that it increases the stability of the financial system. As of October 31, 2014, 113 countries had an explicit deposit insurance program in place, while 40 other countries were either in the process of its implementation or had some form of implicit guarantees.[1] In addition, as a response to the financial crisis of 2007-08, many countries such as Germany, Italy, and the U.S. added government guarantees to certain types of deposits in order to ensure depositors' confidence in the face of unstable market conditions. For countries without explicit deposit insurance, governments are likely to face extreme political pressure to act as guarantors when a widespread crisis occurs and the financial system is destabilized. Demirguc-Kunt, Kane, and Laeven (2008) argue that every country offers implicit deposit insurance, no matter how strongly its top officials may deny it.[2]

The main argument for introducing deposit insurance is to minimizing the probability of deposit runs and financial contagion. An explicit deposit insurance regulation can also reduce the political pressure to bail out failed financial institutions (see Mortlock and Widdowson, 2005). On the other hand, deposit insurance is criticized because it can reduce depositors' monitoring and disciplining incentives, potentially allowing banks to engage in excessive risk-taking. Whether deposit insurance reduces the probability of bank runs is theoretically ambiguous. In a seminal paper, Diamond and Dybvig (1983) present a model where banks make long term loans funded

[1] International Association of Deposit Insurers (IADI) http://www.iadi.org/di.aspx?id=67.

[2] Any private insurance fund faces the risk of a run on its liquid assets. In times of financial instability, depositors may lose their trust in the credibility of the insurance fund's promise to cover deposits. Government guarantees can help restore depositors' confidence and prevent panic-based deposit runs. Government guarantees introduced after the financial crises are still in effect in Germany, Italy and the U.S. In many other G10 countries, they were used only as a temporary measure and were left to expire by the end of 2013. Examples include Australia, Denmark, and Singapore.

with demand deposits. In a "good" equilibrium, only depositors who experienced a liquidity shock withdraw funds. In a "bad" equilibrium, however, there is a run on the bank. The authors show that deposit insurance rules out the bad equilibrium, because depositors no longer fear losing their money. Deposit insurance, however, can decrease the incentives for depositors to monitor and discipline banks. Previous studies (for example, Demirguc-Kunt and Detragiache, 2002, Wagster, 2007, and Anginer et al., 2014) provide evidence for an increase in the risk-taking activities of financial institutions after the introduction of deposit insurance.

The impact of deposit insurance often varies across jurisdictions, over time, and with the specific design of the insurance scheme. Demirguc-Kunt and Detragiache (2002), for example, examine the effect of deposit insurance in 60 countries and conclude that explicit deposit insurance decreases bank stability, and that the effects are stronger in countries with a weak institutional environment. On the other hand, several papers have argued that deposit insurance does not necessarily lead to an increase in risk-taking behavior. Karels and McClatchey (1999) show that credit unions that become insured experience a decrease in the loan delinquency ratio. Similarly, Anginer et al. (2014) provide evidence that introducing deposit insurance leads to an increase in risk-taking activities during "normal" times but it had a strong "stabilization" effect during the recent financial crisis. Allen et al. (2011) provides several solutions to mitigate the distortions introduced by deposit insurance, such as risk-based insurance pricing, strong regulatory environment, and co-insurance mechanisms.

In this paper, we examine the impact of deposit insurance design on the risk of financial cooperatives using a sample of 107 credit unions located in British Columbia, Canada for the period April 1992 to December 2014. In particular, we analyze the effect of a policy amendment introduced in November 2008 to offer protection to depositors in response to the financial crisis. The amendment introduced two changes. First, the maximum deposit coverage was increased from $100,000 to unlimited for all eligible deposits. Second, the insurance premium levied was changed from a flat

rate to a charge based on the institution's risk ratings.[3] There are several different channels through which changes in deposit insurance program could affect the earnings uncertainty of credit unions. First, the unlimited deposit coverage may strengthen depositors' confidence and reduce the probability of panic-based withdrawals. Second, risk-based insurance premiums may provide incentives for credit unions to adjust their risk management practices and optimize the level of risk-taking. In contrast, fully insured depositors may lack the incentives to monitor and discipline credit unions so that these institutions end up taking greater risks and/or investing less resources in improving operational efficiency. Finally, the increase in coverage may attract new flow of funds to credit unions. Deposit inflows can be used to fund income-earning loan assets. Excessive loan asset growth, however, may lead to deterioration in asset quality, and therefore to higher losses in the long run (see Hess et al., 2009, Foos et al., 2010, and Amador et al., 2013). These additional deposits may also represent greater liquidity risk for the credit union when depositors decide to make large withdrawals in the future.

We follow Kuritzkes and Schuermann (2008) and convert credit union earnings into a return-based measure by dividing (pre-tax) net income by risk-weighted assets.[4] We call this the return on risk-weighted assets or $RORWA$. Figure 1 represents the empirical distribution of $RORWA$ before (Panel A) and after the policy change (Panel B), whereas Figure 2 depicts the conditional volatility of $RORWA$ over the sample period. Both figures show that there was a decrease in the portfolio risk of credit unions associated with the policy change. In our formal analysis, we show that the extreme loss (the left tail of the empirical distribution of $RORWA$) after the policy change is smaller than the extreme loss before the change at conventional confidence levels (99% and above). Our regression results show that the change in the deposit insurance program decreased credit unions' earnings uncertainty. The effect

[3]The credit union ratings are assigned by the regulators based on site visits and supervisory examination.

[4]The credit unions calucate the risk-weighted assets according to the regulator's Capital Adequacy Return Completion Guide.

is economically large and statistically significant with 1.15% decrease in the annualized conditional volatility of $RORWA$. We find that the policy change resulted in stronger deposits and loans growth for credit unions relative to the Canadian banks during the same time period. Also, following the policy change, the credit unions in our sample improved their capital-to-asset ratio. We show that the effect of the policy changes varied across credit unions in that it was stronger for smaller, less levered unions as well as for unions with smaller market share. Overall, our results support the hypothesis that an increase in deposit insurance coverage ensures depositors' confidence, and a risk-based insurance premium helps alleviate moral hazard problems and discourages excessive risk taking.

Financial cooperatives differ from commercial banks in several important ways. First, commercial banks are owned by shareholders, who have voting rights based on the class and fraction of shares they hold. Cooperatives, on the other hand, are owned by their members, the depositors, who have equal voting rights regardless of the size of their deposit accounts. Secondly, cooperatives, unlike commercial banks, often focus on different objectives and scope of operations. Cooperatives are non-profit, operate in localized areas and provide services mostly to individuals and small businesses. They distribute earnings to their members in the forms of higher interest on deposits, lower interest on loans, as well as directly through cash dividends. In contrast, commercial banks are for-profit entities whose goal is to maximize shareholder values. They are larger in size, have wider geographic reach and provide services to large, often multinational, corporations as well as individuals and small businesses. Finally, cooperatives and commercial banks may have different regulatory status. Table 1 outlines explicit provisions for deposit insurance coverage in the G10 countries for banks and other deposit-taking institutions.[5] The table shows that, for some countries, financial cooperatives are subject to different deposit insurance regulations (denoted by D), while in other countries the deposit insurance regulations for banks and cooperatives are the same (denoted by ND).[6]

[5]The information is from Demirguc-Kunt, Kane, and Laeven (2014).

[6]WOCCU (2005) is a guide to credit union legislations worldwide. In the table, the coverage

In Canada, commercial banks are federally regulated by the Office of the Superintendent of Financial Institutions (OSFI). The Canada Deposit Insurance Corporation (CDIC) provides deposit insurance for eligible bank deposits. Canadian cooperatives (credit unions), on the other hand, are subject to provincial regulations where each province implements its own deposit insurance program. Cooperative financial institutions are an important part of the financial system. They are the main alternative to commercial banks in providing financial services to consumers and small businesses in Canada. Credit unions fund 12.5% of the residential mortgages (see Crawford et al., 2013). Moore (2014) suggests that the market shares of credit unions vary across provinces, from 4% in Ontario to over 30% in Quebec.

The literature on risk-taking of financial institutions focuses primarily on commercial banks and devotes little attention to financial cooperatives. According to Hesse and Cihak (2007), only 0.1% of published research relates to cooperative banking. Our paper complements the existing literature by examining the impact of deposit insurance on the earnings uncertainty of credit unions. Currently, there are discussions on regulatory reform to break provincial borders and bring Canadian credit unions under the federal charter. The implementation of such policies may lead to drastic shifts in the regulatory environment of credit unions. Our paper contributes to these discussions and sheds light on how a change in deposit insurance may affect these institutions. The remainder of this paper is organized as follows. Section 2 describes the sample data and presents some summary statistics. Section 3 discusses the methodology we use in the study. The results are discussed in Section 4. Finally, Section 5 concludes the paper and suggests possible opportunities for future research.

applies on a per-depositor-per-institution basis in all G10 countries, except for the U.S. where both the single and joint accounts of a depositor at a institution are covered up to the limit. These insurance liabilities are funded privately from insurance premium collected ex ante.

2 Data and Summary Statistics

Our sample contains proprietary financial information for 107 Canadian credit unions, headquartered in the province of British Columbia, for the period April 1992 to December 2014. The data include information from the monthly financial reports, including balance sheets and income statements. Other statistics include the amount of loans in arrears, unfunded loans and the number of credit union depositor-members. Several data items are reported quarterly, e.g. variable- and fixed-rate assets and liabilities. The final sample consists of 18,682 credit union-month observations.

Table 2 presents summary statistics for the credit unions in our sample. [7] The average (median) credit union has CAD$477.50 ($95.97) million in total assets. There is a wide variation in size with the bottom decile of credit union size of only CAD$12.29 million and the top decile of CAD$990.16 million. The average (median) credit union holds 20.30% (17.39%) of its total assets in cash or other liquid assets (*Liquid assets*), and 76.80% (79.48%) in loan assets (*Net loans*). Residential mortgages are the main category of loan assets for credit unions representing 70.5% of all loan assets. A loan with a loan-to-value ratio above 75% is considered a high ratio loan. Most of the high ratio mortgages are insured. The uninsured high-ratio loans are on average 2.34% of total residential mortgages, or 1.32% of total assets. For the average (median) credit union, nonperforming loans, i.e. loans that are at least 30 days past due and are not yet written off as assets, are 0.98% (0.73%) of total assets. On the liability side, the average credit union holds CAD$425.37 million in deposits, 33.93% of which are demand deposits (*Demand deposits*). *Gap ratio* measures the balance sheet mismatch. For variable-rate assets and liabilities, the mean (median) gap ratio is 48.27% (46.08%). For fixed-rate assets and liabilities with 4-6 months to maturity, the mean (median) gap ratio is 40.57% (40.04%). The average (median) capital-to-asset ratio is 5.71% (5.55%).

In Panel C of Table 2, the average monthly net income is $0.188 million. Non-interest income is 12.22% of total net income (interest plus non-interest income). The

[7] The variable definitions are in Table A1 in the Appendix to this paper.

annualized mean (median) monthly return on risk-weighted assets is 0.84% (1.08%) and the annualized volatility of the return on risk-weighted assets over the sample period has an average of 2.99%. In Panel D, the average credit union has 22,329 members, and 1.46% of the market share in terms of deposits. The scores on senior management and board oversight are ratings assigned to the credit unions by the regulators based on site visits and supervisory examinations. The highest score is 4; the lowest is 1. The average score is 3.058 for senior management, and 2.785 for board oversight.

3 Research Design

As discussed in the previous section, we use the return on risk-weighted assets $RORWA_{i,t} = \frac{NI_{i,t}}{RWA_{i,t}}$ as a measure of union i earnings during time period t. NI is net income and RWA is the dollar value of the risk-weighted assets. We begin with a Value-at-Risk analysis and compare the left tail of the empirical distribution of $RORWA$ before and after the policy change. Then, we estimate linear regression models of measure of ex-post earnings uncertainty to examine the effect of the change in deposit insurance on credit union risk. We estimate the following model:

$$Risk_{i,t} = \alpha_i + \beta \times DI_t + \gamma \times Control\ variables_{i,t} + \theta \times Year_t + \epsilon_{i,t} \qquad (1)$$

We use two measures of $Risk$. The first measure is the conditional volatility of $RORWA$ derived from a GARCH(1,1) model. The second measure is the realized volatility of $RORWA$ estimated using a 3-year rolling window.[8] DI is a dummy variable that equals 1 for time periods after the change in the deposit insurance program and 0 otherwise. A positive β indicates that on average the change is associated with higher earnings uncertainty whereas a negative β indicates that the change is associated with lower uncertainty. $Control\ variables$ include credit union

[8]We scale both the conditional and the realized volatility so that we can compare coefficients across regression specifications.

size (measured as the natural logarithm of total assets), liquid assets as a fraction of total assets, and net loans-to-asset ratio as a measure of credit unions asset-liability structure (see Efing et al., 2015 for details). Additional control variables that capture the union's systemic importance and risk-taking incentives are membership measured as the natural logarithm of the number of depositor-members, market share of total deposits, and the governance scores on senior management and board oversight. Equation (1) also controls for union and year fixed effects.

Next, we examine the possible channels through which the change in deposit insurance influenced credit unions' earnings uncertainty. We identify four channels: (1) depositor confidence: the increase in insurance coverage may increase depositors' confidence and therefore prevent panic-driven deposit withdrawals; (2) risk-based premium: the risk-based insurance premiums may discourage excessive risk-taking; (3) moral hazard: in the absence of incentives, depositor-shareholders may be unwilling to monitor and discipline credit unions, and as a result increase risk-taking and/or decrease operating efficiency; (4) new deposit influx: a surge of new funds into the credit union system may create additional liquidity risk.

To examine the effect of these channels, we first compare the deposit and loan growth as well as the loan quality for the sample of credit unions versus a sample of Canadian commercial banks for the period before and after the deposit insurance policy change. Note that the deposit insurance policy change did not affect Canadian commercial banks. Then, we examine the effect of the policy change on alternative measures of ex-ante risk-taking as the dependent variable in equation (1). In particular, we use the proportion of non-interest to total income, the proportion of high-ratio to total mortgages, and the capital-to-asset ratio.

We also examine how the effect of the change in deposit insurance program varies across different financial cooperatives. First, we test whether the policy change had a different effect on large vs small credit unions. Previous studies have shown that, in the context of the banking industry, size matters in terms of the effect of financial regulations on these institutions. We argue that large institutions have better access

to resources and are more resilient to changes in the economic and regulatory environment. Also, the deposit insurance is more likely to improve depositors' confidence for smaller credit unions. As a result, the change would benefit smaller institutions more than the larger ones. However, from a market discipline point of view, larger institutions are monitored closely by the regulators, whose monitoring efforts would not change after the policy is implemented. This, to some degree, mitigates the moral hazard issues associated with deposit insurance. We estimate the following model:

$$Risk_{i,t} = \alpha_i + \beta \times DI_t + \delta \times DI_t \times SMALL_{i,t} + \gamma \times Control\ variables_{i,t} + \theta \times Year_t + \epsilon_{i,t} \quad (2)$$

where $SMALL$ equals to 1 if the size (log of total assets) of a credit union is below the sample median during a 3-year period before the policy change, and 0 otherwise. The rest of the variables are the same as in equation (1).

We examine whether credit unions with higher leverage reacted differently to the changes in the deposit insurance program. Le (2013) shows that after the introduction of deposit insurance, an increase in leverage drives an increase in risk taking for banks. However, the banks that were highly levered before the deposit insurance adoption did not respond to the policy change. Highly levered institutions may not be able to further increase leverage (risk-taking), because regulators often monitor these financial institutions' capitalization very closely. However, new depositors/investors may still prefer well-capitalized credit unions even though their deposits are fully covered by the deposit insurance program. We estimate the following model:

$$Risk_{i,t} = \alpha_i + \beta \times DI_t + \delta \times DI_t \times LOWLEV_{i,t} + \gamma \times Control\ variables_{i,t} + \theta \times Year_t + \epsilon_{i,t} \quad (3)$$

where $LOWLEV$ equals to 1 if the leverage ratio of a credit union is below the sample median during a 3-year period before the policy change, and 0 otherwise.[9] The rest of the variables are the same as in equation (1).

[9]The leverage ratio is calculated as $1 - \frac{capital}{assets}$. For robustness check, we use risk-weighted assets in place of total assets and exclude other liabilities in the calculation. The results remain the same.

Finally, we examine whether credit unions' response to the policy change depend on their systemic importance. During crises, the government can be under political pressure to bail out "too-big-to-fail" financial institutions, i.e. systemically important credit unions are likely to have an implicit guarantee. The explicit deposit insurance should have a smaller effect for these credit unions. We use membership and market share in terms of deposits as two proxies of the systemic importance of credit unions. The failure of a credit union will affect more people if the union has a large member base. Similarly, more deposits in dollar amount will be affected if a credit union with a large share of the deposit market fails. To examine the impact of systemic importance on credit unions' response to the policy change, we augment equation (1) to include the interaction term between DI and membership or market share.

$$Risk_{i,t} = \alpha_i + \beta \times DI_t + \delta \times DI_t \times SYSTEMIC_{i,t} + \gamma \times Control\ variables_{i,t} + \theta \times Year_t + \epsilon_{i,t} \quad (4)$$

where $SYSTEMIC$ is either the (logarithm of) number of depositor-members or the market share of the credit union. The rest of the variables are the same as in equation (1).

4 Estimation Results

4.1 Baseline model: The overall effect of the policy change

Table 3 presents the left tail of the empirical distribution of the mean-adjusted return on risk-weighted assets, $RORWA$. Panel A includes all credit unions whereas Panel B only includes the credit unions remaining active after the change in the deposit insurance program.[10]

In Panel A, the 99 percentile of $RORWA$ for the full sample is -0.98%, i.e. 99% of the time, the monthly earnings did not fall below 0.98% of the average earning. The

[10]Due to a sharp decline in the number of credit unions in recent years, we re-estimate all models with a balanced sample to control for possible attrition bias. The results remain the same.

value is -1.02% for the time period before the change and -0.69% after the change. The table shows that (for conventional confidence levels) $RORWA$ quantiles for the time period after the change are much larger than the values for the time period before the policy change. In Panel B, the extreme loss after the change at each confidence level is again smaller than that before the change, although the spreads between the two are small.

Table 4 presents the results from the estimation of equation (1). All specifications are estimated with union and year fixed effects and robust standard errors.[11] In Panel A, the dependent variable is the conditional volatility of $RORWA$ derived from a GARCH(1,1). The coefficients for DI are negative and significant for all regression specifications. In column (5) (the complete specification) the policy change is associated with 1.15% decrease in the annualized conditional volatility of $RORWA$. The coefficients are consistent across different specifications. The table also shows that the score on management is associated with lower conditional volatility of $RORWA$, whereas the score on board oversight is associated with higher conditional variance. In Panel B, the dependent variable is the realized volatility of $RORWA$ calculate as a standard deviation using a three-year rolling window. The results are consistent with those in Panel A.

4.2 Deposit insurance effect: Channels and credit union characteristics

Table 5 compares the deposit and loan asset growth and loan quality of the credit unions versus those of commercial banks. In Panel A, the total deposits growth rate for credit unions is on average 7.72% lower than the deposits grow rate for banks during the full sample period. In the time period after the policy change, both credit unions and banks exhibited slower deposit growth. This of course is due to the 2007/2008 financial crisis. However, deposit growth at credit unions was more

[11] For ease of presentation, the coefficient in Panel A of Table 4 are multiplied by 10,000 ; and in Panel B by 100.

robust when compared to the growth rate for banks. After controlling for the change in deposits growth rate at banks, the deposits growth rate at credit unions after the policy change is 14.81% higher than the rate before the policy change. The pattern is similar for demand deposits growth. After controlling for the growth rate at banks, the credit unions' demand deposits growth rate after the policy change is 7.45% higher than the rate before the change.

In Panel B of Table 5, credit unions' loan assets growth rate after the policy change is 4.49% higher than the rate before the change in relation to banks. Together with the deposits growth results, this is consistent with the hypothesis that the increase in deposit insurance coverage enhances depositors' confidence and attracts fund influx to credit unions, which then use the funds to enlarge their loan portfolios. Also in Panel B, the credit unions have stronger loan commitments growth than the banks do only in the time periods before the policy change. After the policy change, the controlled growth rate is 13.14% lower than the rate before the change, suggesting that credit unions are slower in extending new credit lines. Loan commitment is a form of liquidity provision. It imposes liquidity risk to the credit unions that provide cash on demand to customers. The slowed expansion of loan commitments can be an indication that credit unions are reluctant and more prudent to take on this type of risk.

Panel C of Table 5 shows that on average credit unions have lower proportion of nonperforming loans when compared to banks. The ratio of nonperforming loans to total loans is 0.76% lower for credit unions. There is no significant shift in the ratio for both unions and banks after the policy change. Overall, our results suggest that credit unions experienced deposit influx as a result of the policy change. They transform the funds into loan assets. In addition, credit unions were exposed to lower liquidity risk in the form of loan commitments and they maintained the quality of their loan assets.

Table 6 reports the effect of the change in deposit insurance program on alternative measures of ex-ante risk-taking. In column (1), the DI dummy is associated

with more income diversification at the credit unions. $Size$ has a negative effect on non-interest income, which is the opposite of the expectation. Credit unions with more liquid assets and net loans have less non-interest income, whereas the unions with more members have more non-interest income. In column (2), the policy change is associated with more high-ratio mortgages. The effect of DI is statistically significant at the conventional level, but is not economically large. The change in deposit insurance program is associated with a 0.01% increase in the high-ratio mortgages, but this effect is very small with only 0.003 standard-deviation increase. Finally in column (3), the policy change has a significantly positive effect on the capital-to-asset ratio. Taking together, the results suggest that the change in deposit insurance program increases credit unions' income diversification and capital ratio, both of which contribute to the lower overall risk at these financial institutions.

Next, we examine how the effect of deposit insurance varies with credit union characteristics. Column (1) of Table 7 presents the estimation results from regression equation (2). The coefficients of DI and the interaction term between DI and $SMALL$ are both significantly negative. The policy change has a greater effect on smaller credit unions; the effect of DI on the annualized conditional volatility of $RORWA$ for the small group is 0.29% higher than the effect for the large group. This is consistent with our hypothesis that larger credit unions are more resilient to changing economic conditions, and that depositors already have confidence in these unions in relation to the smaller ones. So the policy change affects larger unions and their customers to a smaller degree. The coefficients for the control variables are consistent with those in Table 4.

Column (2) of Table 7 includes the estimation results from equation (3). The coefficients of DI and the interaction term between DI and $LOWLEV$ are both significantly negative. The policy change is more effective for credit unions with lower leverage ex ante. This lends support to the hypothesis that even though the deposit insurance program provides homogeneous coverage to eligible deposits at all credit unions, depositors and investors are selective and prefer better capitalized and

less levered credit unions. Another possibility is that credit unions cannot adjust their leverage ratios easily or at low costs. Highly levered credit unions may try to bring down the leverage ratio in response to the implementation of risk-based insurance premium. The adjustments will raise the uncertainty in returns during the process. Overall, our result suggests that the policy change has a larger effect on credit unions with lower leverage.

4.3 The importance of systemic risk

In this section, we examine the impact of credit unions' systemic importance on the effect of the change in the deposit insurance program. We consider unions with a larger membership base and a larger market share in deposits as more important such that the failure of these unions would touch more people and affect greater value in deposits. In Table 8, the coefficient of DI is negative, while the coefficients of the interaction terms between DI and the proxies of systemic importance are positive. It suggests that the policy change has a greater effect on unions of lower systemic importance. This is consistent with the notion of implicit government guarantee on financial institutions. Systemically important credit unions are more likely to receive bail-out from the government, with or without an existing financial safety net or legislative mandate. If such implicit guarantee is a possibility in perception, then an explicit insurance program would not have a significant impact on these credit unions. Our results support this conjecture.

5 Conclusions

In this paper, we examine the effect of an amendment in the deposit insurance program on the earnings uncertainty of credit unions. The amendment consists of two changes: an increase in the insurance coverage to unlimited and the adoption of risk-based insurance premium. We find that overall these changes in the deposit insurance program decreases the conditional variance of the returns on risk-weighted

assets of the credit unions. The increase in insurance coverage is likely to enhance depositors' confidence, represented by strong deposits growth at the credit unions after the policy change. Our results also show that the policy change increases credit unions' non-interest income and capital-to-asset ratio. These can be devices utilized by the credit unions to reduce risk in response to the implementation of the risk-based insurance premium. In addition, we find that the effect of the policy change is larger for smaller and less levered credit unions, as well as those unions of less systemic importance.

Canadian credit union legislation is unique, because these financial institutions are regulated at the provincial level. Several regulatory bodies and deposit insurance programs exist across provinces. It segments the credit union system that is relatively small in size compared to the rest of the financial system. This may hinder the efficiency of operating a deposit insurance program that assumes geographically and industrially concentrated risks. Future research may consider the viability of a deposit insurance program in a small and highly concentrated financial system.

References

[1] Acharya, Viral V., Joao A. C. Santos, and Tanju Yorulmazer, 2010, Systemic Risk and Deposit Insurance Premiums, *Federal Reserve Bank of New York Economic Policy Review*, August 2010.

[2] Allen, Franklin, Elena Carletti, and Agnese Leonello, 2011, Deposit insurance and risk taking, *Oxford Review of Economic Policy* 27-3: 464-478.

[3] Amador, Juan Sebastian, Jose E. Gomez-Gonzalez, and Andres Murcia Pabon, 2013, Loan growth and bank risk: new evidence, *Financial Markets and Portfolio Management* 27: 365-379.

[4] Anginer, Deniz, Asli Demirguc-Kunt, and Min Zhu, 2014, How does deposit insurance affect bank risk? Evidence from the recent crisis, *Journal of Banking & Finance* 48: 312-321.

[5] Bhattacharya, Sudipto, Arnoud W. A. Boot, and Anjan V. Thakor, 1998, The Economics of Bank Regulation, *Journal of Money, Credit and Banking* 30-4: 745-770.

[6] Campbell, Tim S., and J. Kimball Dietrich, 1983, The Determinants of Default on Insured Conventional Residential Mortgage Loans, *The Journal of Finance* 38-5: 1569-1581.

[7] Crawford, Allan, Cesaire Meh, and Jie Zhou, 2013, The Residential Mortgage Market in Canada: A Primer, *Bank of Canada Financial System Review* December 2013.

[8] Demirguc-Kunt, Asli, and Enrica Detragiache, 2002, Does deposit insurance increase banking system stability? An empirical investigation, *Journal of Monetary Economics* 49: 1373-1406.

[9] Demirguc-Kunt, Asli, Edward J. Kane, and Luc Laeven, 2008, Adoption and design of deposit insurance, *Deposit Insurance Around The World*, Chapter 2, MIT Press.

[10] Demirguc-Kunt, Asli, Edward Kane, and Luc Laeven, 2014, Deposit Insurance Database, *IMF Working paper*.

[11] Diamond, Douglas W., and Philip H. Dybvig, 1983, Bank runs, deposit insurance, and liquidity, *Journal of Political Economy* 91-3: 401-419.

[12] Efing, Matthias, Harald Hau, Patrick Kampkotter, and Johannes Steinbrecher, 2015, Incentive pay and bank risk-taking: Evidence from Austrian, German, and Swiss banks, *Journal of International Economics* 96: S123-S140.

[13] Foos, Daniel, Lars Norden, and Martin weber, 2010, Loan growth and riskiness of banks, *Journal of Banking and Finance* 34: 2929-2940.

[14] Gale, Douglas, and Martin Hellwig, 1985, Incentive-Compatible Debt Contracts: The One-Period Problem, *The Review of Economics Studies* 52-4: 647-663.

[15] Hess, Kut, Arthur Grimes, and Mark Holmes, 2009, Credit losses in Australasian banking, *The Economic Record* 85: 331-343.

[16] Hesse, Heiko, and Martin Cihak, 2007, Cooperative Banks and Financial Stability, *IMF Working Paper*.

[17] Hughes, Joe, and Loretta J. Mester, 2015, Measuring the Performance of Banks: Theory, Practice, Evidence, and Some Policy Implications, *The Oxford Handbook of Banking*, 2nd Edition.

[18] Kuritzkes, Andrew, and Til Schuermann, 2008, What we know, don?t know and can?t know about bank risk: a view from the trenches, *The Known, The Unknown and The Unknowable in Financial Risk Management*, Chapter 6, Princeton University Press 2010.

[19] Laeven, Luc, 2008, Pricing of Deposit Insurance, *Deposit Insurance Around The World*, Chapter 3, MIT Press.

[20] Le, Mathias, 2013, Deposit insurance adoption and bank risk-taking: the role of leverage, Working paper.

[21] Moore, Phil, 2014, Credit Union System Structure: A look at where we are today and some of our challenges for the future, *Credit Union Central of Canada*.

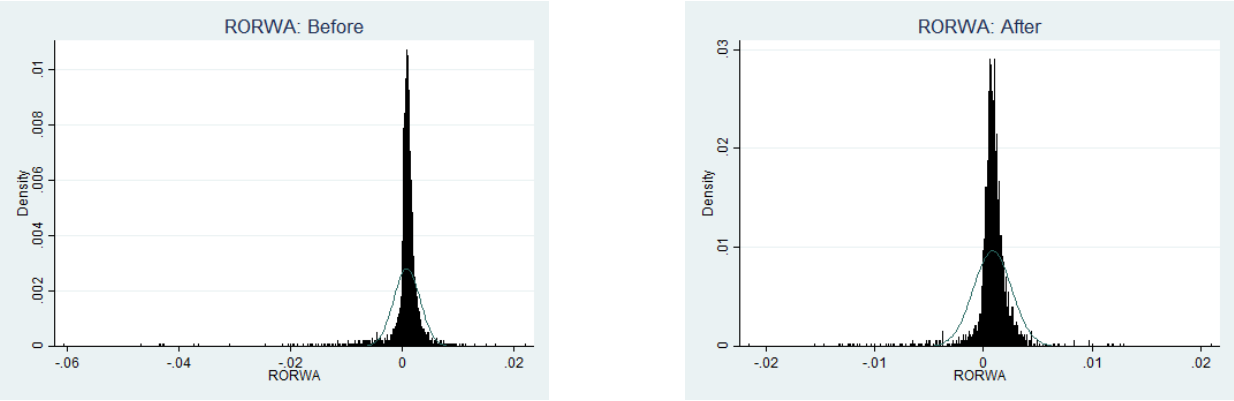
[22] Mortlock, Geof, and Doug Widdowson, 2005, Deposit insurance: should New Zealand adopt it and what role does it play in a bank failure, *Reserve Bank of New Zealand*.

[23] Tanda, Alessandra, 2015, The Effects of Bank Regulation on the Relationship Between Capital and Risk, *Comparative Economic Studies* 57: 31-54.

[24] Wagster, John D., 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.

[25] WOCCU, 2005, Guide to International Credit Union Legislation 4th Edition, *World Council of Credit Unions*.

Figure 1: Distribution of Return on Risk-Weighted Assets



(a) (b)

Figure 2: Conditional Volatility of Return on Risk-Weighted Assets

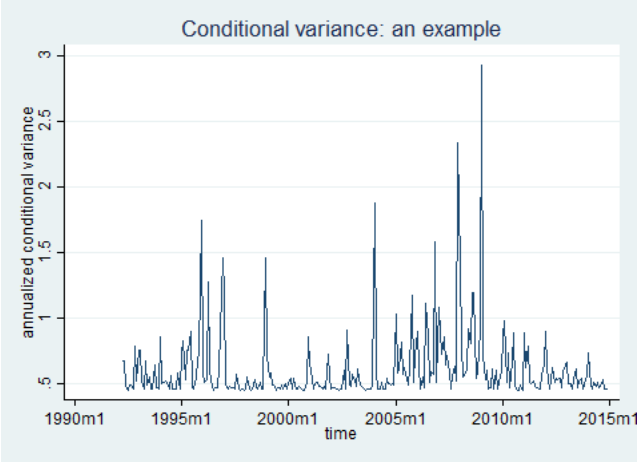


Table 1: Deposit insurance coverage in G10 countries

The table outlines explicit deposit insurance programs in G10 countries for banks or deposit-taking institutions in general. The information is extracted from Demirguc-Kunt et al. (2014), and is up to date as of 2013. D (ND) indicates that the deposit insurance program for cooperatives is (not) different from that for the rest of the financial system.

Country	Statutory coverage	Change since 2008		Cooperatives
		Increased coverage	Government guarantee	
Belgium	EUR 100,000	y		ND
Canada	CAD 100,000			D
France	EUR 100,000	y		ND
Germany	EUR 100,000	y	y	D
Italy	EUR 100,000		y	D
Japan	JPY 10,000,000			D
Netherlands	EUR 100,000	y		ND
Sweden	EUR 100,000	y		ND
Switzerland	CHF 100,000	y		ND
United Kingdom	GBP 85,000	y		ND
United States	USD 250,000	y	y	D

Table 2: Summary statistics

The table presents summary statistics for our sample, an unbalanced panel of 107 credit unions from 1992 to 2014. Panel A and B include balance sheet characteristics of the credit unions. Panel C presents measures of income and the return on risk-weighted assets. Panel D presents the proxies for credit union's systemic importance and the governance scores. The variable definitions are in Appendix 1.

	Mean	Median	Std Dev	1 pctl	99 pctl
Panel A: Assets					
Total assets ($millions)	477.50	95.97	1,547.00	0.36	9,485.34
Liquid assets	20.30%	17.39%	10.39%	8.32%	57.38%
Net loans	76.80%	79.48%	10.24%	40.89%	89.73%
High-ratio mortgages	1.32%	0.13%	2.85%	0.00%	14.94%
Nonperforming loans	0.98%	0.73%	0.95%	0.00%	4.46%
Panel B: Liabilities and capital ratio					
Total deposits ($millions)	425.37	89.48	1,349.48	0.34	8,371.78
Demand deposit	33.93%	33.35%	13.32%	0.00%	69.15%
Gap ratio: variable rate	48.27%	46.08%	29.91%	0.94%	100.00%
Gap ratio: fixed rate 4 - 6 months	40.57%	40.04%	23.28%	0.83%	90.25%
Capital-to-asset ratio	5.71%	5.55%	1.57%	2.68%	11.36%
Panel C: Incomes and returns					
Net income, monthly ($millions)	0.188	0.032	0.969	-0.420	3.936
Non-interest income	12.22%	12.63%	37.46%	-0.01%	34.52%
Return on risk-weighted assets	0.07%	0.09%	0.74%	-0.91%	0.58%
Volatility of RORWA, annualized	2.99%	0.64%	20.28%	0.18%	13.01%
Panel D: Governance indicators					
Membership	22,329	7,381	56,356	246	372,613
Market share	1.46%	0.38%	3.78%	0.00%	23.35%
Score on senior management	3.058	3.000	0.589	2.000	4.000
Score on board oversight	2.785	3.000	0.502	1.000	4.000

Table 3: Left tail of the mean-adjusted return on risk-weighted assets

The table presents the quantiles representing extreme losses from the empirical distribution of the mean-adjusted return on risk-weighted assets. The values are drawn for three time periods. The *full* period is from April 1992 to December 2014. The period *before* the change in deposit insurance is from April 1992 to October 2008. The period *after* the change is from November 2008 to December 2014. In Panel A, returns from all credit unions are included to construct the distribution. Panel B uses a subsample of credit unions that remain active after October 2008.

	Full	Before	After
Panel A: All credit unions			
Number of observations	18,575	15,271	3,304
Confidence level			
99%	-0.98%	-1.02%	-0.69%
99.5%	-1.40%	-1.56%	-1.06%
99.9%	-4.33%	-4.41%	-1.49%
Panel B: Subsample of credit unions			
Number of observations	12,808	9,504	3,304
Confidence level			
99%	-0.82%	-0.84%	-0.69%
99.5%	-1.18%	-1.21%	-1.06%
99.9%	-2.23%	-2.53%	-1.49%

Table 4: Deposit insurance and credit union risk

The table presents the results from the estimation of regression equation (1). In Panel A, the dependent variable is the conditional variance of the return on risk-weighted assets ($RORWA$) estimated from a GARCH(1,1) model. In Panel B, the dependent variable is the standard deviation of $RORWA$ calculated in a 3-year rolling window. DI is a dummy variable that equals to 1 for time periods after the change in deposit insurance and 0 otherwise. The rest of the variables are defined in Appendix 1. P-values are reported in brackets. All regressions are estimated with credit union fixed effects, year fixed effects and robust standard errors. "*", "**", and "***" denote 10%, 5%, and 1% significance level, respectively.

Panel A: Conditional variance of $RORWA$					
	(1)	(2)	(3)	(4)	(5)
DI	-0.1039***	-0.1056***	-0.1054***	-0.1106***	-0.1098***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Size		-0.0030	-0.0138	-0.0276	-0.0546
		(0.925)	(0.755)	(0.496)	(0.321)
Liquid assets		-0.9271	-0.8842	-0.0845	0.0216
		(0.170)	(0.191)	(0.874)	(0.964)
Net loans		-1.2278*	-1.1871*	-0.3616	-0.2554
		(0.082)	(0.086)	(0.473)	(0.527)
Membership			0.0176		0.0318
			(0.725)		(0.631)
Market share			0.2045		1.0222
			(0.607)		(0.101)
Governance score: management				-0.0270**	-0.0318*
				(0.011)	(0.053)
Governance score: board				0.0380*	0.0406*
				(0.066)	(0.094)
Credit union F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Number of observations	12,749	12,749	12,749	9,163	9,163
Adjusted R^2	0.047	0.047	0.047	0.041	0.041

Panel B: Realized volatility of $RORWA$					
	(1)	(2)	(3)	(4)	(5)
DI	-0.0005***	-0.0023***	-0.0024**	-0.0012*	-0.0007
	(0.000)	(0.003)	(0.012)	(0.054)	(0.380)
Size		0.0133	0.0202	-0.0157*	-0.0351
		(0.163)	(0.425)	(0.068)	(0.153)
Liquid assets		-0.2375	-0.2386	-0.1495	-0.1420
		(0.354)	(0.360)	(0.449)	(0.484)
Net loans		-0.4283	-0.4285	-0.3056	-0.2999
		(0.131)	(0.135)	(0.168)	(0.182)
Membership			-0.0079		0.0249
			(0.822)		(0.495)
Market share			-0.0657		0.0630
			(0.733)		(0.769)
Governance score: management				-0.0329**	-0.0350**
				(0.024)	(0.013)
Governance score: board				0.0228***	0.0239***
				(0.007)	(0.003)
Credit union F.E.	Yes	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes	Yes
Number of observations	14,947	14,947	14,947	11,344	11,344
Adjusted R^2	0.680	0.683	0.683	0.563	0.563

Table 5: Deposits and loans, before and after the change in deposit insurance program

The table compares the deposit growth, loan growth, and loan quality at credit unions and commercial banks. "*", "**", and "***" denote 10%, 5%, and 1% significance level, respectively, from sample mean and group mean comparison t tests.

Panel A: Deposit growth						
	deposits, growth			demand deposits, growth		
	cu	bank	cu - bank	cu	bank	cu - bank
All years	8.01%***	15.74%***	-7.72%***	8.82%***	17.66%	-8.84%***
Before the change	8.69%***	18.64%***	-11.54***	8.59%***	17.53%***	-8.94%***
After the change	5.02%***	7.11%***	-2.09%	9.85%***	18.17%***	-8.33%***
After - Before	-3.67%***	-11.53%***	14.81%***	1.26%	0.64%	7.45%***
Panel B: Loan growth						
	loans, growth			loan commitments, growth		
	cu	bank	cu - bank	cu	bank	cu - bank
All years	8.54%***	9.55%***	-1.02%	14.62%***	8.36%***	6.26%***
Before the change	9.37%***	10.74%***	-1.36%	16.82%***	7.32%***	9.50%***
After the change	4.83%***	5.82%***	-0.99%	5.27%***	10.39%**	-5.11%*
After - Before	-4.55%***	-4.92%**	4.49%*	-11.55%***	3.07%	-13.14%**
Panel C: Loan quality						
	nonperforming loans					
	cu	bank	cu - bank			
All years	0.98%***	1.75%***	-0.76%***			
Before the change	1.01%***	2.08%***	-1.07%***			
After the change	0.85%***	0.92%***	-0.08%			
After - Before	-0.08%	-3.30%	3.22%			

Table 6: Alternative risk measures

The table presents the results from the estimation of regression equation (1). Alternative risk measures are used as the dependent variable in each column. DI is a dummy variable that equals to 1 for time periods after the change in deposit insurance and 0 otherwise. The rest of the variables are defined in Appendix 1. P-values are reported in brackets. All regressions are estimated with credit union fixed effects, year fixed effects and robust standard errors. "*", "**", and "***" denote 10%, 5%, and 1% significance level, respectively.

	(1) Non-interest income	(2) High-ratio mortgage	(3) Captal-to-asset
DI	0.0135***	0.0001**	0.0006***
	(0.000)	(0.035)	(0.000)
Size	-0.0530***	0.0040	-0.0211***
	(0.000)	(0.173)	(0.000)
Liquid assets	-0.6455***	-0.0437	0.0820***
	(0.000)	(0.144)	(0.000)
Net loans	-0.7355***	-0.0345	0.0961***
	(0.000)	(0.248)	(0.000)
Membership	0.0546***	0.0074**	0.0190***
	(0.000)	(0.033)	(0.000)
Market share	-0.0661	0.1614***	-0.1217***
	(0.485)	(0.001)	(0.000)
Governance score: management	-0.0010	-0.0040**	-0.0040***
	(0.830)	(0.019)	(0.000)
Governance score: board	0.0039	0.0027**	-0.0033***
	(0.382)	(0.024)	(0.000)
Credit union F.E.	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes
Number of observations	13,094	13,144	13,144
Adjusted R^2	0.273	0.648	0.769

Table 7: Impact of credit union characteristics before the change in deposit insurance

The table examines the impact of credit union characteristics. $SMALL$ is 1 for credit unions with average assets below the sample median during the 3-year period before the change in deposit insurance, and 0 otherwise. $LOWLEV$ is 1 for credit unions with average leverage ratio below the sample median. P-values are reported in brackets. All regressions are estimated with credit union fixed effects, year fixed effects and robust standard errors. "*", "**", and "***" denote 10%, 5%, and 1% significance level, respectively.

Panel A: Conditional variance of $RORWA$		
	(1)	(2)
DI	-0.0786***	-0.0895***
	(0.000)	(0.000)
DI * SMALL	-0.0546***	
	(0.006)	
DI * LOWLEV		-0.0384**
		(0.032)
Size	-0.0676	-0.0568
	(0.236)	(0.306)
Liquid assets	0.1261	0.0425
	(0.797)	(0.931)
Net loans	-0.1643	-0.2625
	(0.684)	(0.524)
Membership	0.0349	0.0428
	(0.611)	(0.548)
Market share	0.6951	0.5501
	(0.286)	(0.455)
Governance score: management	-0.0366**	-0.0295*
	(0.043)	(0.059)
Governance score: board	0.0524*	0.0405*
	(0.059)	(0.095)
Credit union F.E.	Yes	Yes
Year F.E.	Yes	Yes
Number of observations	8,992	8,992
Adjusted R^2	0.041	0.041

Panel B: Realized volatility of $RORWA$		
	(1)	(2)
DI	-0.0066	-0.0010
	(0.554)	(0.900)
DI * SMALL	-0.0038	
	(0.605)	
DI * LOWLEV		-0.0002
		(0.992)
Size	-0.0322	-0.0308
	(0.204)	(0.231)
Liquid assets	-0.1174	-0.1135
	(0.547)	(0.564)
Net loans/assets	-0.2878	-0.2833
	(0.186)	(0.190)
Membership	0.0292	0.0296
	(0.412)	(0.405)
Market share	-0.0001	-0.0021
	(1.000)	(0.992)
Governance score: management	-0.0361***	-0.0356**
	(0.009)	(0.011)
Governance score: board	0.0248***	0.0243***
	(0.003)	(0.004)
Credit union F.E.	Yes	Yes
Year F.E.	Yes	Yes
Number of observations	11,086	11,086
Adjusted R^2	0.573	0.573

Table 8: Impact of systemic importance

The table examines the impact of systemic importance on the effect of deposit insurance. In Panel A, the dependent variable is the conditional variance of the return on risk-weighted assets ($RORWA$) estimated from a GARCH(1,1) model. In Panel B, the dependent variable is the standard deviation of $RORWA$ calculated in a 3-year rolling window. DI is a dummy variable that equals to 1 for time periods after the change in deposit insurance and 0 otherwise. P-values are reported in brackets. All regressions are estimated with credit union fixed effects, year fixed effects and robust standard errors. "*", "**", and "***" denote 10%, 5%, and 1% significance level, respectively.

Panel A: Conditional variance of $RORWA$		
	(1)	(2)
DI	-0.5200***	-0.1180***
	(0.002)	(0.000)
DI * membership	0.0455**	
	(0.013)	
DI * market share		0.9608*
		(0.086)
Size	-0.0789	-0.0535
	(0.186)	(0.322)
Liquid assets	0.2219	0.0371
	(0.651)	(0.938)
Net loans	-0.0598	-0.2397
	(0.879)	(0.553)
Membership	0.0353	0.0347
	(0.593)	(0.602)
Market share	-0.7556	-0.4076
	(0.448)	(0.699)
Governance score: management	-0.0239*	-0.0318*
	(0.085)	(0.052)
Governance score: board	0.0296	0.0406*
	(0.169)	(0.093)
Credit union F.E.	Yes	Yes
Year F.E.	Yes	Yes

Panel B: Realized volatility of $RORWA$		
	(1)	(2)
DI	-0.0688***	-0.0001
	(0.008)	(0.959)
DI * membership	0.0072***	
	(0.007)	
DI * market share		-0.0280
		(0.645)
Size	-0.0401	-0.0355
	(0.106)	(0.148)
Liquid assets	-0.1565	-0.1365
	(0.441)	(0.504)
Net loans/assets	-0.3166	-0.2947
	(0.160)	(0.192)
Membership	0.0220	0.0254
	(0.539)	(0.487)
Market share	-0.0241	0.0938
	(0.920)	(0.667)
Governance score: management	-0.0355**	-0.0351**
	(0.012)	(0.014)
Governance score: board	0.0227***	0.0238***
	(0.005)	(0.003)
Credit union F.E.	Yes	Yes
Year F.E.	Yes	Yes
Number of observations	11,344	11,344
Adjusted R^2	0.564	0.563