EFFECT OF ABNORMAL LOAN GROWTH ON U.S. CREDIT UNION PERFORMANCE

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ABSTRACT

This study examined the relationship between abnormally rapid loan growth and its impacts on U.S. credit union performance during 2007 – 2013. Three hypotheses were developed to test whether and how abnormal loan growth affects default risk, profitability, and solvency in credit unions. This study found that 1) rapidly loaning credit unions had larger average loan loss, smaller average profitability and solvency than normally loaning credit unions; 2) market concentration exhibited a negative and significant impact on default risk, profitability, and solvency; and 3) A size of credit union also exhibited a negative and significant impact on profitability and solvency. These results suggest that supervisors and boards of directors of credit unions should consider rapid loan growth as an early warning sign of risk.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

As a principal activity of banks, lending behavior has been studied extensively. Since the recent financial crisis, concern increased that banks have experienced abnormally rapid loan growth because of excessively easy credit standards. Large commercial banks had significant losses during the financial crisis (Koehler, 2012). Several studies pointed out that abnormal loan growth could lead to an increase in loan loss and reduced profit (Foos et al., 2010; Sinkey and Greenawalt, 1991; Amador et al., 2013). Foos et al. (2010) claimed that abnormally rapid loan growth should be considered as a risk. They used more than 10,000 individual banks in 14 major western countries during 1997-2005 and found abnormal loan growth increases loan loss and decreases profitability and solvency. Sinkey and Greenawalt (1991) studied large commercial banks in the U.S. for the period of 1984-1987 and discovered that the average past loan growth is significantly and positively associated with the contemporaneous loan loss rate. Amador et al. (2013) studied abnormal loan growth in Colombian banks during 1990-2011 and found that excessive loan growth reduces solvency and increases the rate of nonperforming loans to total loans.

This study examined whether and how loan growth of credit unions affect their loan loss, profitability, and solvency. While many studies analyzed loan growth and its riskiness at commercial banking level (Foos et al., 2010; Sinkey and Greenawalt, 1991; Amador et al., 2013), there was no study about impacts of loan growth on U.S. credit union performance. The effect of abnormal loan growth in European banks or developing countries' banks may be different from that of U.S. banks because all business environment is different. Also, the effect of abnormal loan growth in commercial banks and credit unions in the U.S. may be different because there are

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critical differences between credit unions and commercial banks in terms of institutional objectives, mix of assets, loan portfolios, governance, etc.

1.1. Definition of credit union

Credit unions are financial cooperatives providing financial products and services to maximize their members' welfare (Davis, 2001). Modern credit unions were established in response to perceived market failures in Germany in the 19th century (McKillop and Wilson, 2011). They aimed to provide external funds to areas that needed them but were not able to obtain them from banks (Isbister, 1993).

Table 1 shows differences between commercial banks and credit unions. Credit unions and investor-owned banks are different in regards to business model and funding structure, and such features generate different incentives for lending. According to National Credit Union Association (NCUA), in the U.S., historical deposit and consumer loan market shares of credit unions have been small, and on average credit unions hold less than 10% of saving deposits and 9% of all consumer loans. Although credit unions have relatively small market shares in the U.S., they specialize in loans for consumers who have limited access to financial resources.

Credit unions and commercial banks have different loan portfolios. Commercial banks focus more on non-lending activities, and non-interest income accounted for 42% of operating income in 2004 (Goddard et al., 2008). Credit unions focus on lending, and they primarily use customer deposits as a source of funding. Non-interest income accounted for 18% of total operating income of credit unions in 2004 (Goddard et al., 2008). Historically, credit unions focus on secured loans, which have low default risk. In 2013, on average, secured loans, including 1st mortgage real estate loans and other real estate loans, accounted for 40% of total consumer loans

of credit unions, and unsecured loans, including credit card loans, accounted for less than 10% of total consumer loans of credit unions (NCUA, 2013).

Table 1. Credit union vs. commercial bank

	Credit union	Commercial bank
Structure	Non-profit financial cooperative made up of member-owners	For-profit corporation owned by stockholders
Objective	Maximize welfare of their member; provide financial services and products to people of modest incomes	Maximize profits for stockholders
Regulator	National Credit Union Association (NCUA)	Federal Deposit Insurance Corporation (FDIC)
Directors	Non-paid volunteers	Paid directors
Governance	Democratically controlled by members	Controlled by stockholders

1.2. Why do banks experience rapid loan growth?

Competition for loan customers has grown and causes banks to reduce loan rates and relax their credit standards to obtain new business opportunities (Foos et al., 2010; Dell'Ariccia and Marquez, 2006). Macroeconomic factors, such as monetary policy and economic growth, also affect lending strategies. The business cycle is related to loan growth and loan losses. During business expansion, loan growth tends to be high. Loan losses tend to be high during recessions (Keeton, 1999). Hardy and Tieman (2008) claimed that improved economic conditions can lead to fast loan growth. They explained that many countries have had fast and steady economic growth and lower inflation. In these countries, income and profitability are expected to be high, households are expected to spend more, and companies are expected to broaden their business. These expectations lead to higher loan demands.

Advanced technology has provided much more sophisticated and cheaper methods for evaluating loan applicants and collaterals and managing risks. "The very rapid expansion of securitization and the use of credit derivatives" (Hardy and Tieman, 2008) are the evidence of this

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trend. Financial institutions have assessed creditworthiness using advanced information technology and large databases and provided financial products and services (Foos et al., 2010; Hardy and Tieman, 2008).

1.3. How do banks increase their lending?

Banks increase their lending by relaxing their credit standards, such as collateral requirements, reducing interest rates, or a combination of both (Dell'Ariccia and Marquez, 2006; Ogura, 2006; Keeton, 1994). Through this mechanism, banks accept loan applicants that were previously unqualified or that have weak credit histories. A reduction in credit standards increases the probability borrowers will eventually default.

Financial institutions are motivated by higher expected future profitability and new business opportunities. These may not be realized without bearing risks. Although advanced loan technology has helped financial institutions to make efficient decisions, the recent financial crisis is a destructive example of the link between excessive credit lending and the risks associated with it. There were two underlying assumptions for this practice: 1) new loans are provided to loan applicants that were unqualified previously or that have weak credit histories; and 2) credit unions required lower interest rates or low collateral. Several studies pointed out that rapid loan growth negatively affects commercial banks in Europe, developing countries, and the U.S. However, there is no evidence showing the effect of abnormal loan growth on U.S. credit union performance. Again, the effect of abnormal loan growth in commercial banks and credit unions in the U.S. may be different because their business environment is different.

To address the question, this study analyzed the relations between abnormal loan growth and three aspects: loan loss, interest income, and solvency. Loan loss represented default risks related to lending. Interest income indicated the compensation for risk taking, and solvency

represented overall fragility or healthiness of credit unions associated with risk taking. These three aspects are closely related to each other and through this study, overall risks associated with loan growth were explored. Different empirical measures were used to explain each point.

1.4. Objectives

In this study, the objective was to analyze whether abnormal loan growth is associated with U.S. credit union riskiness. Using National Credit Unions Association' data during 2007-2013, the three relationships between 1) abnormal loan growth and loan loss; 2) abnormal loan growth and profitability; and 3) abnormal loan growth and solvency of credit unions were examined. Abnormal loan growth (ALG) was measured as difference in percentage between an each credit union's loan growth rate and the median loan growth rate of all credit unions from the same year. This technique was used by Foos et al. (2010).

To test the objective, three hypotheses were developed. First, this study analyzed whether past abnormal loan growth affects contemporaneous loan losses of credit unions. Berger and Udell (2004) showed that borrowers do not instantly fail to repay, and if borrowers fail to repay, it will occur within two or three years after the loans have been granted. Past rapid loan growth was expected to increase future default risks.

Second, this study analyzed the impact of abnormal loan growth on the profitability of credit unions. Profitability is critical to keep running their business and to maintain trustworthiness about their services among their members. If credit unions provide loans at lower interest rates by relaxing credit standards, interest income would be lower. The reduced profitability may potentially reduce solvency of credit unions if reduced profitability is not compensated by enough net worth (Almarzoqi et al., 2015).

Third, this study analyzed how loan growth influences credit unions' solvency. Solvency risk is that a financial institution cannot repay debts because value of its liabilities is greater than the amount of its assets. The equity-to-total asset (EQA) ratio is used to represent solvency of a financial institution (Stockopedia, 2016). The EQA ratio is a widely used financial ratio to measure the health of a financial institution. Abnormal loan growth was expected to decrease the EQA ratio and reduce the ability of credit unions to deal with unexpected losses and to meet maturing obligations.

1.5. Contributions

This study contributes to the available literature in several ways. Most of the previous studies analyzed the relationship between abnormal loan growth and its effects on performance at commercial banking level. This study used credit union financial data and investigated the impact of abnormal loan growth and its effects on performance in credit unions. Although credit unions have relatively small market shares in the U.S., they specialize in loans for consumers who have limited access to financial resources. This study compared two types of credit unions: 1) credit unions whose loan growth is less than median loan growth of all credit unions in the same year; and 2) credit unions whose loan growth is greater than median loan growth of all credit unions in the same year. By comparing two categories of credit unions, this study hope to catch distinctly positive or negative effects of rapid loan growth on U.S. credit union performance.

1.6. Thesis outline

The remainder of the thesis was organized as follows. Chapter 2 discusses related literature on abnormal loan growth. Chapter 3 presents the data set and methodology. Chapter 4 shows report the main results and concluding statements are presented in Chapter 5.

2. LITERATURE REVIEW

2.1. Definition of credit union

Credit unions are finance cooperatives found in the retail financial sectors. Their objective is to promote member welfare by providing financial products and services. In some cases, credit union membership is limited by common bond requirement based on residence, occupation, or association. A common bond is advantageous for credit unions because it can reduce the cost of evaluating the creditworthiness of potential borrowers and thereby it facilitates lending on reasonable terms to a credit union's members.

The board members are elected by the entire membership and serve voluntarily. Feinberg and Rahman (2006) said that non-paid volunteer board of directors give credit unions cost advantages. However, Frame et al. (2003) pointed out that the governance structure of mutually owned institutions have greater agency problems than investor-owned institutions "because the marginal private benefit accruing to a single shareholder of monitoring management is likely much less than the marginal cost."

2.2. Challenges: deregulation and advanced information technology

Fraser and Zardkoohi (1996) noted that deregulation was related to an increase in risk-taking behavior. Deregulation in credit union industry started in the 1970s and this has led to threats and opportunities. Deregulation during the 1970s and 1980s affected credit union industry significantly both in terms of products and services they were permitted to provide and in terms of their management. Deregulation in 1990s has led to less restrictive common bond requirement and increased potential membership size and mergers and acquisition opportunities (Wheelock and Wilson, 2013).

As a result of deregulation, over the years there has been a significant change in the credit union industry both in terms of the number of credit unions and the asset size. For example, the number of credit unions decreased from 10,316 in 2000 to 7,339 in 2011. Total assets increased from $ 438.2 billion in 2000 to $963 billion in 2011 (Sant, 2012).

The common bond requirement is a critical information advantage over banks for a certain class of borrower. There was homogeneity among their customers, so the common bond requirement allowed credit unions to obtain detailed information of local economic situations, to screen potential members, and thus to evaluate borrowers efficiently (McKillop and Wilson, 2011). However, this comparative advantage of credit unions has been diluted because of advanced information technology. Information technology has been developed and provided much more sophisticated and cheaper methods for evaluating loan applicant repayment ability and managing overall risks (Foos et al., 2010; Hardy and Tieman, 2008).

Although severe competition and deregulation have somewhat diluted distinct features of credit unions, commercial banks and credit unions are still different in terms of objectives, markets they serve, governance, regulation, etc. This study analyzed whether the loan decisions made by management of credit unions lead to similar consequences (i.e. an increase of loan loss and a decrease of profitability and solvency) caused in commercial banks.

2.3. Abnormal loan growth and its riskiness

In the introduction, several studies were introduced and their finding indicated that new loans are granted to borrowers that were previously unqualified and require lower loan rates or low collateral. It suggested that rapid credit growth tends to be accompanied by relaxed credit standards.

Dell'Ariccia and Marquez (2006) studied the relationship between lending standards and lending booms. They found that as information accessibility across banks is increased ("when banks have an increased loan applications and an increased number of rivals"), they may relax their credit standards. In turn, it leads to lower profits and make them unstable during recessions. Ogura (2006) discovered that banks are affected by lending strategies of their competitors and adjust credit standards more attractive for borrowers. In turn, it increases the total risk taken by the entire banking industry.

A degree of market concentration affects banks' business strategies, capital structure, risk-taking behavior, and the cost of financing. There are two different theories on the impact of competition in banking sector on financial stability. The 'competition-fragility' theory argues that competition in banking sector increases moral hazard and encourages banks to take more risks (Marcus, 1984; Keeley, 1990). On the other hand, the 'competition-stability' theory argues that competition positively affects bank stability and reduce default risk of banks because larger banks can achieve economies of scale and scope and diversify their risks (Diamond, 1984; Boyd and Prescott, 1986).

Hart and Moore (1998) claimed that perfect competition favors investor owned companies, compared to cooperatives because stockholders are interested in profits and members in cooperatives are concerned with their benefits. They explained that members of cooperatives feel less pressure from market competition because credit unions have cost advantages (i.e. non-paid volunteer boards of directors and federal tax exempt status). This study assumed in favor of the 'competition-fragility' theory that competition may encourage credit unions to increase lending by reducing their credit standards, or lowering loan rates, or a combination of both, and in turn, loan growth increases risks associated with lending.

Some studies pointed out diversification as a cause of loan growth. Lepetit et al. (2008) studied how the expansion of European banks during 1996-2002 affected their profitability and loan pricing. They found that higher income from commissions and fees tends to decrease margins and loan rates. Berger et al. (2010) studied diversification and its effects on bank performance using Chinese banks data for the period of 1996-2006. Their findings showed that diversification in loans, deposits, assets, and geography tends to reduce profits and to increase costs.

Several empirical studies based on U.S. data provided evidence that loan growth may lead to a gradual increase of future loan losses. Sinkey and Greenawalt (1991) analyzed large banks in the U.S. for the period of 1984-1987 and showed that the contemporaneous loan loss rate is significantly positively associated with the average past loan growth. Berger and Udell (2004) studied the procyclicality of bank lending in the U.S. during 1980-2000. They discovered that lending standards are loosened and banks provide more loans as time goes by "since a bank's last peak in loan losses."

 Loan growth has consequences in European banks, as well as U.S. banks. Foos et al. (2010) investigated the relationship between loan growth and the riskiness of banks in 14 Western Europe countries during 1997-2005. Loan growth leads to an increase in loan loss provision, a reduced profitability, and a reduced solvency. Salas and Saurina (2002) investigated Spanish commercial and savings banks during 1985-1997 and showed that loan growth of savings banks has a significant, positive relationship with loan losses that occurred three (four) years ago.

Finally, there were several studies that analyze the relationship between loan growth and banking crises in transition economies and developing countries. Amador et al. (2013) used a full panel of Colombian financial institutions during 1990–2011 to discover the relationship between banks' risk-taking behavior and abnormal loan growth. Their finding indicated that abnormal

credit growth tends to lead to an increase in the ratio of nonperforming loans to total loans and a reduction of solvency. Kraft and Jankov (2004) studied credit growth in Croatian banks and found: "rapid loan growth increased the probability of credit quality deterioration and increased current account and foreign debt problems."

3. DATA AND METHODOLOGY

Annual credit union financial data was used to estimate statistical model relating loan loss, profitability and solvency with loan growth. Other factors considered included asset size and loan market concentration. Fixed effects were considered to isolate unique effects of individual credit unions.

3.1. Fixed effect model

Panel data, also called longitudinal data or cross-sectional time series data, is a data set including observations on multiple cases observed over multiple time periods. Panel data regression allows to take advantage of both, the cross-sectional information reflected in the differences between subjects and the time-series information reflected in the changes within subjects over time. The second advantage is that panel data models can control for a greater degree of individual heterogeneity that characterizes credit unions (Stock and Watson, 2003). Panel data methodology makes the consideration of a firm-specific, time-invariant effect, possible.

Fixed and random effect methods are commonly used to estimate statistical models using panel data. Each credit union has its own individual characteristics that may or may not influence the predictor variables in fixed effect models (Stock and Watson, 2003). For example, credit unions can differ systematically regarding location, the number of members, and management. These individual characteristics are time-invariant.

Fixed effect models would help in reducing the effects of omitted variable bias and endogeneity. Also, these reduce collinearity among the explanatory variables and, therefore, improves the precision of econometric estimates. Finally, possible biases in the resulting estimates caused by the correlation between unobservable individual effects and the independent variables could be removed.

To test whether fixed effect statistical models are appropriate for our data, the Hausman test was used.

$$y_{i,t} = \beta_0 + \beta_x X_{i,t} + \beta_z z_i + v_i + \epsilon_{i,t} \hspace{2cm} \text{(Eq.1)}$$

Equation 1 explains what the Hausman test examines. Y is a dependent variable. i is an individual credit union. t is any one of T time points. X is a variable that vary over time. Z is a variable that do not vary over time. v_i is individual effects. $\epsilon_{i,t}$ is regression errors (Gutierrez and Sanford, 2015).

Random effect models assume that v_i and $\epsilon_{i,t}$ are uncorrelated with each independent variable. If an independent variable satisfy both condition, it is exogenous. However, if one or both condition is violated, an independent variable is endogenous (Gutierrez and Sanford, 2015). The Hausman test statistic was 40.65 and the value was significant at the 1% level. This result indicated that there are group effects or time effects or both and Ordinary Least Squares (OLS) or Generalized Least Squares (GLS) become biased and inconsistent. Based on the Hausman test result, a fixed effect model was estimated.

3.2. Variables

This section describes each of the variables in detail. Total consumer loans (TL) were measured by summing eight loan categories. Those are: total first mortgage real estate loans/lines of credit, used vehicle loans, total other real estate loans/lines of credit, new vehicle loans, total all other loans/lines of, all other unsecured loans/lines of, unsecured credit card loans, and lease receivables.

Loan growth (LG) was measured as a percentage change of total consumer loans from the year t-1 to year t. Abnormal Loan Growth (ALG) is measured as the difference between an individual credit union's loan growth rate and the median aggregate loan growth rate of all credit

unions from the same year: $ALG_{i,t}=LG_{i,t} - Median\ aggregate\ LG_{c,t}$ (Foos et al., 2010). The median is the middle score for a set of data that has been arranged in order of magnitude and it is less affected by outliers and skewed data. The reason median was used instead of average is that some credit unions have extremely high or low loan growth rates (UCLA, 2015). For example, the largest observed loan growth rate is approximately 300%, and the lowest value is -46%. Since the data are not symmetrically distributed around a typically observed value, using an average may distort the data distribution and the mean value of the data may not accurately reflect the typical loan growth of a credit union.

A set of past abnormal loan growth variables in year t-1, t-2, and t-3 was included based on the finding that borrowers do not instantly fail to repay, and if borrowers fail to repay, it will occur within two or three years after the loans have been granted. (Berger and Udell, 2004; Foos et al., 2010). Abnormal loan growth in year t-1, for example, was measured as the difference between a credit union's loan growth rate in year t-1 and the median aggregate loan growth rate of all credit unions in year t-1.

Loan loss ($LL_{i,t}$) was measured as the ratio of "loan loss provisions established in year t relative to total consumer loans in year t-1" (Foos et al., 2010; Laeven and Majnoni, 2003). Loan loss provision is established for bad loans that are unlikely to be repaid. Loan loss in year t-1 ($LL_{i,t-1}$) was included in one of the empirical models to address the assumption that past loan loss affects to contemporaneous loan loss. The correlation coefficient between contemporaneous loan loss (lnLL) and loan loss in year t-1 (lnLL1) was 0.5775, and it was statistically significant at the 1% level (p<0.0001).

Total interest income (II) was the sum of interest on loans (less interest refunded), income from investments, and trading profits and losses. It contributes to a measure profitability by

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measuring loan and investment revenues. The equity-to-total asset (EQA) ratio measures capitalization. The EQA ratio is a widely used financial ratio to gauge the health of a financial institution. High EQA ratios indicate low leverage and, therefore, less risk. It is measured as the fraction of total equity relative to the total asset in the same year in a credit union. A high EQA ratio shows a credit union's ability to deal with unexpected losses due to lending or other activities (Stockopedia, 2016).

The Herfindahl-Hirschman Index (HHI) is measured by the sum of squared fractions of all outstanding consumer loans provided by banks and credit unions in the county in which the credit union is headquartered (Hays and Ward, 2011). The HHI represented the degree of market concentration. The HHI can range from close to zero to 10,000. A monopolized market would have a 10,000 HHI. It was expected that credit unions have different strategies based on degree of competition, each ultimately affecting the three parameters – loan loss, profitability, and solvency.

Table 2. Variable description

Variables	Descriptions
TL	Total consumer loans in a credit union
II	Total interest income, a proxy of profitability
EQA	Equity-to-total asset ratio, a proxy of solvency
$LL_{i,t}$	Contemporaneous loan loss
$LL_{i,t-1}$	Loan loss in year t-1
LG	Loan growth, a percentage change in the amount of total consumer loans from the year t-1 to year t
ALG	Contemporaneous abnormal loan growth
$ALG_{i,t-1}$	Abnormal loan growth in time lag 1 year
$ALG_{i,t-2}$	Abnormal loan growth in time lag 2 year
$ALG_{i,t-3}$	Abnormal loan growth in time lag 3 year
HHI	Herfindahl-Hirschman Index
AB	AB=1, if a credit union's loan growth > median loan growth of aggregate credit unions from the same year

A dummy variable, AB, was 0 for credit unions having loan growth smaller than aggregate median loan growth from the same year and 1 for having loan growth greater than aggregate

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median loan growth from the same year. A dummy variable, AB, was used to test for the presence of different profitability, solvency, and loan losses in credit unions whose loan growth was greater than median aggregate loan growth and credit unions whose loan growth was less.

3.3. Data sources

The final data was balanced and consisted of total 1375 credit unions and their yearly financial data for the period of 2007 - 2013. A few variables required data from two subsequent years. Abnormal loan growth in year t-3 needed loan data in year t-3 and t-4 to measure loan growth rate change in year t-3 relative to loan growth rate in year t-4.

The raw data used for analyses was yearly Call Reports of National Credit Unions Association (NCUA) from 2002 to 2013, and it contained 98,086 annual observations from 9,805 credit unions. 7,517 observations from 2,228 credit unions were dropped because they did not operate for seven consecutive years (in part due to mergers, acquisitions, and bankruptcy); or, one of the important variables (total consumer loans, loan loss provisions, interest income, or the equity-to-total asset ratio) was missing. The values for loan loss, relative interest income, and the equity-to-total asset ratio below 3% and above 97% quantile were considered to be outliers and were excluded these observations from all analyzes.

Table 2 displays descriptive statistics for variables and the total number of credit unions in the final data set from 2007 to 2013. The final data was balanced and consisted of yearly data of 1375 credit unions.

For measuring Herfindahl-Hirschman Index (HHI) of total consumer loans, commercial banks data and credit unions loan data from 2002 to 2013 were merged. Credit unions data was obtained from NCUA and commercial banks data was obtained from the Federal Deposit Insurance

Corporation (FDIC). 2010 FIPS Codes was used to distinguish counties and county-equivalent entities, and the codes are obtained from the United States Census Bureau.

Table 3. Descriptive statistics

Description	Variable	N	Mean	Median	Std. Dev	Minimum	Maximum
Total Consumer Loan	TL	9695	74,986,448	36,201,705	94,746,934	219,938	621,044,586
Relative Interest Income (in %)	RII	9695	8.21201	7.89758	1.95488	4.4901	24.77088
Equity-to-total asset ratio (in %)	EQA	9695	8.87094	8.33613	3.51397	0.80243	25.52520
Loan Loss (in %)	LL	9695	0.72313	0.56616	0.58913	0.02748	4.54171
Abnormal Loan Growth Rate (in %)	ALG	9695	2.54530	2.15296	7.65604	-20.89049	28.91563
log(HHI)	lnHHI	9695	8.02743	8.06563	0.73389	5.86132	9.21034

3.4. Abnormal loan growth and loan losses

In this section, the relationship between abnormal loan growth and loan losses was modeled. It was expected there is a relationship between rapid loan growth in the past and a decrease of the average credit quality of a credit unions' loan portfolio. Based on the presumption that credit standards are relaxed to attract new borrowers, rapid loan growth leads to a decrease in the average credit quality of a credit union's loan portfolio and finally to loan losses.

The following regression model was estimated to observe the presence and strength of the relationship of these variables and loan loss:

$$\ln LL_{i,t} = \alpha + \beta_1 lnLL_{i,t-1} + \sum_{K=1}^{3} \beta_{K+1} ALG_{i,t-K} + \beta_5 lnTL_{i,t} + \beta_6 lnHHI_{i,t} + \beta_7 AB +$$

$$\sum_{K=1}^{3} \beta_{K+7} (AB * ALG_{i,t-K}) + \beta_{12}(AB * lnTL_{i,t}) + \beta_{13}(AB * lnHHI_{i,t}) + \beta_{14}(AB * lnLL_{i,t-1})$$

(Eq.2)

Since all values of loan loss were greater than zero, the natural logarithm of this variable (lnLL) was used. As contemporaneous changes in loan loss provisions is closely related to past loan losses, a lagged dependent variable of loan loss in year t-1 was included. Again, abnormal loan growth variables in year t-1, t-2, and t-3 were included based on the experience that if

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borrowers fail to repay, it will occur within two or three years after the loans have been granted (Berger and Udell, 2004). If credit unions increase their total consumer loans by granting loans to lower-quality borrowers, a significantly positive relationship between loan losses and past loan growth should be found.

To control for individual credit union size, the natural logarithm of total consumer loans (lnTL) was included. Larger credit unions would have economies of scale, and it may provide more opportunities for larger credit unions to diversify their loan portfolio and reduce default risks. The coefficient of lnTL was expected to be negative, which indicates economies of scale reduce loan loss.

A dummy variable, AB, was used to see a difference between credit unions whose loan growth was greater than median aggregate loan growth and credit unions whose loan growth was less than the median aggregate loan growth. By comparing two categories of credit unions, the dummy variable was expected to catch distinctly positive or negative effects of rapid loan growth on loan loss. Each variable was interacted with the dummy variable and these interaction terms were included.

All values of HHI were greater than 0, so the natural logarithm of this variable (ln HHI) was used. Based on the 'competition-fragility' theory that competition increases moral hazard and encourages banks to take more risks (Marcus, 1984; Keeley, 1990), market concentration was expected to increase loan loss.

The model was estimated as fixed effect model with Newey and West error correction option, which is a commonly used to control heteroscedasticity and autocorrelation correction.

3.5. Abnormal loan growth and profitability

In this section, the relationship between profitability and abnormal loan growth was modeled. Competition for loan customers has grown and causes banks to reduce loan rates and relax their credit standards to obtain new business opportunities (Foos et al., 2010; Dell'Ariccia and Marquez, 2006). Relative interest income was a ratio of total interest income over total consumer loans (Foos et al., 2010). If loans are provided at lower interest rates, total outstanding consumer loans produce lower interest incomes.

The following regression was used to explain the relative interest income by the contemporaneous abnormal loan growth and a set of other variables:

$$\ln\text{RII}_{i,t} = \alpha + \beta_1 ALG_{i,t} + \beta_2 lnTL_{i,t} + \beta_3 lnHHI_{i,t} + \beta_4 AB + \beta_5(AB * ALG_{i,t}) +$$

$$\beta_6(AB * lnTL_{i,t}) + \beta_7(AB * lnHHI_{i,t}) \tag{Eq.3}$$

The dependent variable was relative interest income and it was a fraction of total interest income relative to total consumer loans. The natural logarithm of $RII_{i,t}$ was used. If credit unions increase their total consumer loans by lowering interest rates, a negative relation between relative interest income and abnormal loan growth should be found.

To control for individual credit union size, the natural logarithm of credit union size (lnTL) was included. Larger credit unions would have economies of scale, and economies of scale may provide more opportunities for larger credit unions to diversify their loan portfolio, reduce cost of funds, and increase profit margins. The coefficient of lnTL was expected to be positive, which indicates economies of scale increase profitability.

A dummy variable, AB, was used to see a difference between credit unions whose loan growth was greater than median aggregate loan growth in the same years and credit unions whose loan growth was less than the median aggregate loan growth in the same year. By comparing two

categories of credit unions, the dummy variable was expected to catch distinctly positive or negative effects of rapid loan growth on relative interest income. Each variable was interacted with the dummy variable, and these interaction terms were included.

All values of HHI were greater than 0, the natural logarithm of this variable (ln HHI) was used. Based on the 'competition-fragility' theory that competition in banking sector increases moral hazard and encourages banks to take more risks (Marcus, 1984; Keeley, 1990), market concentration was expected to decrease profitability. Based on this assumption, market concentration was expected to have a negative impact on relative interest income.

The model was estimated as fixed effect model with Newey and West error correction option, which is a commonly used to control heteroscedasticity and autocorrelation correction.

3.6. Abnormal loan growth and solvency

In this section, this study regressed the natural logarithm of the equity-to-total asset (EQA) ratio of each credit union i in the year t on contemporaneous abnormal loan growth and other independent variables. The EQA ratio is a widely used financial ratio to measure the health of a financial institution. It shows a credit union's ability to meet its obligations and to deal with unexpected losses due to lending or other activities.

$$\ln EQA_{i,t} = \alpha + \beta_1 lnALG_{i,t} + \beta_2 lnTL_{i,t} + \beta_3 lnHHI_{i,t} + \beta_4 AB + \beta_5(AB * lnALG_{i,t}) +$$
$$\beta_6(AB * lnTL_{i,t}) + \beta_7(AB * lnHHI_{i,t}) \qquad (Eq.4)$$

To control for individual credit union size, the natural logarithm of credit union size (lnTL) was included. Larger credit unions would have economies of scale, and economies of scale may provide more opportunities for larger credit unions to diversify their loan portfolio, reduce cost of funds, and increase profit margins. The coefficient of lnTL was expected to be positive, which indicates economies of scale increase solvency.

A dummy variable, AB, was used to see a difference between credit unions whose loan growth was greater than median aggregate loan growth in the same years and credit unions whose loan growth was less than the median aggregate loan growth in the same year. By comparing two categories of credit unions, the dummy variable was expected to catch distinctly positive or negative effects of rapid loan growth on solvency. Each variable was interacted with the dummy variable, and these interaction terms were included.

All values of HHI were greater than 0, so the natural logarithm of this variable (ln HHI) was used. Based on the 'competition-fragility' theory, first and second empirical models assumed that market concentration would encourage credit unions to take more risks, and in turn, it increases loan loss and reduces profitability. The coefficient of lnHHI was expected to decrease solvency because loan loss decrease asset values, and reduced profitability has a negative impact on net worth of credit unions.

The model was estimated as fixed effect model with Newey and West error correction option, which is a commonly used to control heteroscedasticity and autocorrelation correction.

4. RESULTS

4.1. Loan growth and loan losses

Table 4 presents the analysis for loan loss. As Hypothesis 1 suggested, there was a positive and significant impact of abnormal loan growth in year t-2 and t-3 on contemporaneous loan loss at the 1% level. The coefficient of abnormal loan growth in year t-2 was the strongest among abnormal loan growth variables. For example, 10 percentage points increase of abnormal loan growth in year t-2 increases contemporaneous loan loss by 4.5%.

The coefficient of loan loss in year t-1 was positive and statistically significant at the 1% level. For example, 10 % increase of loan loss with a time lag of 1 year would increase contemporaneous loan loss by 2.4%. The interaction term between dummy variable, AB, and loan loss in year t-1 was negative but statistically insignificant. Thus, this study could not detect a difference of effect of loan loss in year t-1 between rapidly loaning credit unions and normally loaning credit unions.

This study could not detect a significant impact of credit union size (measured by $\ln TL_{i,t}$) on contemporaneous loan losses. However, the interaction term between the dummy variable, AB, and credit union size was negative and significant at the 1% level. This finding suggests that credit union size would have a stronger negative impact on loan loss in rapidly loaning credit unions as compared to normally loaning credit unions.

Rapidly loaning credit unions had higher average loan loss than normally loaning credit unions. The coefficient of AB was positive and statistically significant at the 5% level, meaning the difference between rapidly loaning credit unions and normally loaning credit unions is significant. The intercept was -3.59 for normally loaning credit unions and -2.99 for rapidly loaning credit unions. The exponentiated value of average loan loss for normally loaning credit

unions is exp(-3.59)=0.028, and for rapidly loaning credit unions the value of average loan loss is exp(-2.99)=0.049.

There were two interesting results. First, the coefficient of market concentration was negative and statistically significant at the 1% level. For example, a 10% increase in market concentration would decrease loan loss by 1.7%. This was a somewhat unexpected result because market concentration was expected to increase loan loss because competition was assumed to force credit unions to reduce their credit standards. Second, the coefficient of $AB * ALG_{i,t-3}$ was negative and statistically significant at the 5% level, and indicates that 1) the effect of abnormal loan growth in year t-3 ($ALG_{i,t-3}$) in rapidly loaning credit unions and normally loaning credit unions was not the same; and 2) $ALG_{i,t-3}$ of rapidly loaning credit unions would help to reduce loan loss. One possible explanation of this is credit unions' loan portfolios. Historically credit unions have mainly granted secured loans and these loans have relatively low default risks. It seems that these low default risk loan portfolios allow credit union to be relatively stable when they face severe competition and helped to reduce default risks.

Table 4. Regression result for loan loss

Dependent var.: $\ln LL_{i,t}$	Coefficients (p-value)
Intercept	-3.5871 (0.0034***)
$\ln LL_{i,t-1}$	0.2401 (<0.0001***)
$\ln TL_{i,t}$	0.0921 (0.1534)
$ALG_{i,t-1}$	0.0024 (0.127)
$ALG_{i,t-2}$	0.0045 (0.0023***)
$ALG_{i,t-3}$	0.0032 (0.0230**)
lnHHI	-0.1742 (0.0001***)
AB	0.5877 (0.0261**)
AB*$\ln LL_{i,t-1}$	-0.0147 (0.4146)
AB* lnTL	-0.0409 (0.0004***)
AB*lnHHI	0.0005 (0.9790)
AB*$ALG_{i,t-1}$	0.0005 (0.8140)
AB*$ALG_{i,t-2}$	-0.0003 (0.8849)
AB*$ALG_{i,t-3}$	-0.0044 (0.0132**)
# of credit unions	1375
R-square	0.5113
F-value	2.11 (<0.0001)

*** p<0.01, ** p<0.05, * p<0.1

4.2. Loan growth and profitability

Table 5 presents the analysis for profitability. As second hypothesis suggested there was a negative relationship between relative interest income and abnormal loan growth. The coefficient of abnormal loan growth was significant and positive at the 1% level. Also, the interaction term between the dummy variable, AB, and abnormal loan growth was negative and significant at the 1% level. Based on these results, a 1 percentage point increase of abnormal loan growth increase relative interest income of normally loaning credit unions by 0.18%, and decrease relative interest income of rapidly loaning credit unions by 0.04%.

There was a significant negative impact of credit union size at the 1% level. This finding supports the assumption that credit unions increase their lending by reducing their credit standard, and in turn, it reduces relative profit margins obtained from total outstanding consumer loans. However, difference of credit union size effect on relative interest income between rapidly loaning credit unions and normally loaning credit unions was insignificant.

The coefficient of market concentration (lnHHI) was significantly negative at the 1% level. For example, 1% increase of market concentration decreased relative interest income by 0.2%. This result favors the 'competition-fragility' theory that competition encourages banks to take more risks, and in turn, increases fragility of banks. However, the interaction term between the dummy variable, AB, and market concentration was statistically insignificant. Thus, this study could not detect difference of market concentration effect between rapidly loaning credit unions and normally loaning credit unions.

The relationship between market concentration and relative interest income could be also explained by the characteristics of market that smaller credit unions serve. Smaller credit unions

tend to serve areas where members have less alternatives to shift their deposits, so smaller credit

unions may charge higher interest rates (Lagoa and Pina, 2015).

Table 5. Regression result for relative interest income

Dependent var.: lnRII$_{i,t}$	Coefficients (p-value)
Intercept	14.0621 (<0.0001***)
$ALG_{i,t}$	0.0018 (0.0008***)
lnTL	-0.5557 (<0.0001***)
lnHHI	-0.1970 (<0.0001***)
AB	-0.0747 (0.1008)
AB*$ALG_{i,t}$	-0.0022 (0.0003***)
AB*lnTL	0.0026 (0.1929)
AB*lnHHI	0.0008 (0.8217)
# of credit unions	1375
R-square	0.7470
F-value	12.61 (<0.0001)

*** p<0.01, ** p<0.05, * p<0.1

4.3 Loan growth and solvency

Table 6 presents the analysis for solvency. As hypothesis 3 suggested there was a negative and significant relationship between abnormal loan growth and the equity-to-total asset (EQA) ratio. The coefficient of abnormal loan growth was significant and positive at the 1% level. The interaction term between the dummy variable, AB, and abnormal loan growth was significant and negative at the 1% level. This finding suggests that a 1 percentage point of abnormal loan growth decrease solvency of rapidly loaning credit unions by 0.05%, and increase solvency of normally loaning credit unions by 0.36%.

The coefficient of market concentration was significantly negative at the 1% level. For example, 1% increase of market concentration decreased solvency by 0.11%. This suggests competition reduces credit union solvency. The interaction term between the dummy variable, AB, and market concentration was statistically insignificant. Thus, this study could not detect a significant difference of market concentration effect on solvency between rapidly loaning credit unions and normally loaning credit unions.

This study detected a significant negative impact of credit union size, and difference between rapidly loaning credit unions and normally loaning credit unions was significant at the 1% level. The coefficient of market concentration suggests that a 10% increase in market concentration will decrease of solvency by 1.06%. This implies that increased market concentration reduces solvency.

The finding mentioned above can be interpreted similarly with the second empirical result. The second empirical result suggested that as credit unions reduce their interest rates to increase their lending, in turn, their relative interest income from total outstanding consumer loans decrease.

In this regard, if reduced profitability of credit unions is not compensated by a large enough net margin, then credit union solvency can also be reduced.

Table 6. Regression result for the equity-to-total asset ratio

Dependent var.: $lnEQA_{i,t}$	Model 1
Intercept	7.0645 (<0.0001***)
$ALG_{i,t}$	0.0036 (<0.0001***)
lnTL	-0.1909 (<0.0001***)
lnHHI	-0.1051 (<0.0001***)
AB	-0.1478 (0.0001***)
AB*$ALG_{i,t}$	-0.0041 (<0.0001***)
AB*lnTL	0.0078 (<0.0001***)
AB*lnHHI	0.0011 (0.7266)
# of credit unions	1375
R-square	0.8944
F-value	43.39 (<0.0001)

*** $p<0.01$, ** $p<0.05$, * $p<0.1$

5. CONCLUSION

This study used National Credit Unions Association (NCUA) data during 2007-2013, and provide evidence on the relationship between past loan growth and loan losses, profitability, and solvency of credit unions. In summary, 1) rapidly loaning credit unions had larger average loan loss, smaller average profitability and solvency than normally loaning credit unions at the 1% level; 2) market concentration exhibited a negative and significant impact on loan loss, profitability, and solvency at the 1% level; and 3) A size of credit union also exhibited a negative and significant impact on profitability and solvency at the 1% level.

Frist, past loan growth has a significantly positive impact on subsequent loan losses with a maximum in the second year. Holding others factors fixed, average loan loss in rapidly loaning credit unions was larger than in normally loaning credit unions. It is worth to notice that 1) past abnormal loan growth in year t-3 for rapidly loaning credit unions reduced loan losses; and 2) severe market competition had a negative impact on loan loss. This study points out that credit unions focus on secured loans that have low default risks. These loans make credit union relatively stable when they face severe competition and help reduce loan loss.

Second, a statistically negative relationship between abnormal loan growth and relative interest income was found. This finding indicates that new loans are provided at lower interest rates and lower loan rates reduce profitability of credit unions. Average relative interest income in rapidly loaning credit unions was smaller than in normally loaning credit unions. A degree of market concentration had a significant, negative impact at profitability at 1% level, and it supports the 'competition-fragility' theory that competition encourages credit unions to take risks and makes financial institutions more fragile. Another possible explanation for this finding is closely related to the characteristic of markets that smaller credit unions tend to serve. Smaller credit

unions tend to serve areas where members have less alternatives to shift their deposits, so smaller credit unions may charge higher interest rates (Lagoa and Pina, 2015).

Third, there was a statistically negative relationship between abnormal loan growth and solvency. Average solvency in rapidly loaning credit unions was smaller than that of normally loaning credit unions at the 1% level. A degree of market concentration and credit union size had a negative and significant impact on solvency at the 1% level. This finding could also be explained in the same context with the second empirical model: 1) severe competition reduces profitability, and in return, net worth of credit unions decreases; and 2) characteristics of market that smaller credit unions tend to serve may enable smaller credit unions to have relatively large market shares in areas and to charge higher interest income that increase net worth.

This study has several implications. Supervisors and boards of directors of credit unions should consider loan growth as an early warning sign of risk. They have to not rush to broaden their business before institutional and managerial capabilities exist. Three empirical models found that rapidly loaning credit unions had larger average loan loss, smaller average profitability and solvency than normally loaning credit unions at the 1% level.

Credit unions have to balance unsecured and secured loans in their portfolios. The first empirical result suggests that credit unions' loan portfolios focus on secured loans and these loans have relatively low default risks. By maintaining healthiness of loan portfolios, credit unions can be stable when they face severe competition.

The second and third empirical models suggest smaller credit unions are more profitable than larger credit unions because the market that smaller credit unions tend to serve has less competition. Heterogeneity among membership may enable credit unions diversify their risks and make their business stable, but it may also bring uncertainty at the same time. Based on this finding,

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credit unions have to adjust their lending strategies based on their market shares, market characteristics, a degree of member diversity, and other features of the market.

Credit unions have to keep using customers' deposit as a main source of loanable funds. Credit unions may use external source of funding from commercial sources such as private banks or governments. Reliance on debt would hurt capital structure of credit union, especially during recessions. Self-financing enhances the awareness among members that they have ownership and responsibility in the institution. Thus, it can lead to good repayment performance (Huppi and Feder, 1989).

REFERENCES

Almarzoqi, R., Naceur, S. B., Kotak, A., 2015. What Matters for Financial Development and Stability? IMF Working Papers, 15(173).

Amador, J. S., Gómez-González, J. E., Pabón, A. M., 2013. Loan growth and bank risk: New evidence. Financial Markets Portfolio Management, Springer 27(4), 365-379.

Berger, A., Udell, G., 2004. The institutional memory hypothesis and the procyclicality of bank lending behavior. Journal of Financial Intermediation 13, 458–495.

Berger, A. N., Hasan, I., Korhonen, I., Zhou, M., 2010. Does diversification increase or decrease bank risk and performance? Evidence on diversification and the risk-return trade-off in banking. BOFIT Discussion Paper 9.

Boyd, J., Prescott, E., 1986. Financial intermediary coalitions. J. Econ. Theory 38, 211–232.

Davis, K., 2001. Credit union governance and survival of the cooperative form. Journal of Financial Services Research 19, 197–210.

Dell'Ariccia, G., Igan, D., Laeven, L., 2008. Credit booms and lending standards: Evidence from the subprime mortgage market. IMF Working Paper 08/106.

Dell'Ariccia, G., Marquez, R., 2006. Lending booms and lending standards. Journal of Finance 61, 2511–2546.

Diamond, D., 1984. Financial intermediation and delegated monitoring. Rev. Econ. Stud. 51, 393–414.

Feinberg, R. M., Rahman, A., 2006. Are Credit Unions Just Small Banks? The Determinants of Bank Rates in Local Consumer Lending Markets: Comparing Market and Institution-Level Results. Eastern Economic Journal, 32(4), 647.

Foos, D., Norden, L., Weber, M., 2010. Loan growth and riskiness of banks. Journal of
    Banking and Finance, 34, 2929–2940.

Frame, W. S., Karels, G. V., Mcclatchey, C. A., 2003. Do credit unions use their tax
    advantage to benefit members? Evidence from a cost function. Review of Financial
    Economics, 12(1), 35-47.

Fraser, D. R., Zardkoohi, A., 1996. Ownership structure, deregulation, and risk in the savings
    and loan industry. Journal of Business Research, 37(1), 63-69.

Goddard, J., Mckillop, D., Wilson, J. O., 2008. The diversification and financial performance
    of US credit unions. Journal of Banking & Finance, 32(9), 1836-1849.

Gorton, G., 2009. Information, liquidity, and the (ongoing) panic of 2007. American
    Economic Review 99, 567–572.

Gutierrez, R, G., Sanford, K., 2015. Working with Panel Data: Extracting Value from
    Multiple Customer Observations. Paper SAS 1755-2015.

Hardy, D. C., Tieman, A. F., 2008. Innovation in Banking and Excessive Loan Growth. IMF
    Working Papers, 08(188), 1.

Hart, O., Moore, J., 1998. Cooperatives vs. Outside Ownership. NBER Working Paper, 6421

Hays, F, H., Ward, S, G., 2011. Understanding Market Concentration: Internet-Based
    Applications from the Banking Industry. Journal of Instructional Pedagogies, 5, 1.

Huppi, M., Feder, G., 1990. The Role of Groups and Credit Cooperatives in Rural Lending.
    The World Bank Research Observer, 5(2), 187-204.

Isbister, J., 1993. The Lending Performance of Community Development Credit Unions.
    University of California, Davis.

Keeley, M., 1990. Deposit Insurance. Risk and Market Power in Banking, American

    Economic Review, December, 1183-1200.

Keeton, W. R., 1999. Does faster loan growth lead to higher loan losses? Economic Review,

    Federal Reserve Bank of Kansas City, Second Quarter, 57-75.

Koehler, M, 2012. Which Banks are more Risky? The Impact of Loan Growth and Business

    Model on Bank Risk-taking. Deutsche Bundesbank Discussion Paper 33.

Kraft, E., Jankov, L., 2005. Does speed kill? Lending booms and their consequences in

    Croatia. Journal of Banking and Finance 29, 105–121.

Lagoa, S., Pina, L, P., 2015. Size and profitability in co-operative banking: a picture from

    inside a Portuguese institution. CIRIEC-España, Revista de Economía Pública, Social y

    Cooperativa 83.

Laeven, L., Majnoni, G., 2003. Loan loss provisioning and economic slowdowns: Too much,

    too late. Journal of Financial Intermediation 12, 178–197.

Lepetit, L., Nys, E., Rous, P., Tarazi, A., 2008. The expansion of services in European

    banking: Implications for loan pricing and interest margins. Journal of Banking and

    Finance 32, 2325–2335.

Marcus, A. J., 1984. Deregulation and bank policy. Journal of Banking and Finance 8, 557- 565.

Mckillop, D., Wilson, J. O., 2011. Credit Unions: A Theoretical and Empirical Overview.

    Financial Markets, Institutions & Instruments, 20(3), 79-123.

Ogura, Y., 2006. Learning from a rival bank and lending boom. Journal of Financial

    Intermediation 15, 535–555.

Salas, V., Saurina, J., 2002. Credit risk in two institutional regimes: Spanish commercial and

    savings banks. Journal of Financial Services Research 22, 203– 224.

Sinkey, J., Greenawalt, M., 1991. Loan-loss experience and risk-taking behavior at large

      commercial banks. Journal of Financial Services Research 5, 43–59.

Stock J, Watson M. W., 2003. Introduction to Econometrics. New York: Prentice Hall.

Stockopedia, 2016. Assets to Equity Ratio. Retrieved March 15, 2016, from

      http://www.stockopedia.com/ratios/assets-to-equity-ratio-5121

UCLA: Statistical Consulting Group. Introduction to SAS. from

      http://www.ats.ucla.edu/stat/sas/notes2 (accessed August 24, 2015)