DEPOSIT INSURANCE AND MORAL HAZARD IN ECUADORIAN CREDIT UNIONS

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Abstract

This paper studies the relation between deposit insurance implementation and moral hazard among Ecuadorian credit unions. We use monthly financial data of 34 credit unions from December 2007 to July 2015. Non-parametric mean difference test and panel data analysis employing monthly risk indicators are used to test for this relationship. Overall, results find no evidence to support our hypothesis that risk levels increased after deposit insurance was implemented in Ecuador on May 2009. However, with some specific indicators, we do find evidence that risk levels increased. Further analysis is needed to find more conclusive results, specially using more observations for the pre deposit insurance period and a VAR specification.

Keywords: deposit insurance, moral hazard, credit union, emerging economies, non-market risk indicators.

JEL CODE: G21; G22; G28; P13; C14; C23.

I. INTRODUCTION

Deposit insurance (DI) schemes are implemented to protect depositors against economic losses in case of financial institutions solvency issues. The main objectives to maintain DI are to provide a financial safety net that reduces the social cost associated with bank failures and to promote financial stability in a given country. Previous studies have shown that deposit insurance can help reducing the probability of bank runs and mitigating the spill-over effect of banks' failures (Diamond and Dybvig, 1983; Calomiris, 2009; Calomiris and Kahn, 1991; Calomiris and Mason, 2003; Eichengreen and Arteta, 2000; and Hoggarth et al., 2005). However, the introduction of deposit insurance can have some negative effects on the system that is being implemented. On the one hand, risk perception of economic agents in the system changes by reducing the risk associated to lending activities. This change in market conditions virtually eliminates the need to differentiate financial institutions by their individual risk levels. On the other hand, as market discipline (i.e. depositors and other creditors monitoring) is reduced, financial institutions have the incentive to take on riskier lending activities because depositors do not required higher returns for the greater risk incurred[1]. Weinstein (1992) argues that banks are sheltered from market discipline because risky activities are unlikely to cause depositors to depart risky banks. This lack of punishment is depositors' signal about their trust in the financial system[2]. More evidence about how safety nets, such as DI, can create incentives for banks to incur in excessive risk-taking behavior can be found in (Merton, 1977, 1978; Kareken and Wallace, 1978; Keeton, 1984; Demirgüç-Kunt and Kane, 2002; Gropp and Vesala, 2004; Nier and Baumann, 2006).

The incentive to increase risk after a policy implementation (i.e., deposit insurance) is known as Moral Hazard. Paul Krugman refers to moral hazard as "any situation in which one person makes the decision about how much risk to take, while someone else bears the cost if things go badly" (Krugman 2009, pg. 63). Within the deposit insurance framework, moral hazard can be defined as a situation in which a financial institution decides on how much risk to take with depositors' funds, while the insurer bears (parts of) the possible negative consequences that arises from the institution's risky behavior. Deposit insurance can catalyze moral hazard because it separates risk from reward (Weinstein, 1992). Thus, as banks can shift risk towards the insurer, the probability that the insurer has to pay, given the insolvency of some banks, increases with moral hazard. Insured institutions have the

1. Insured depositors are insensitive to banks' asset choice or capital level because with DI they hold a risk-free asset (Karels and McClatchey (1999).
2. It is worth noting that this increase in depositors trust is one the main objective of Deposit Insurance.

incentive to use lower-cost insured deposits to undertake higher projects than would otherwise be optimal (IADI 2013). Possible solutions to this problem are to charge risk-adjusted premiums or to impose higher capital requirements[3]; however, these solutions can negatively impact efficiency in the system. Ignoring moral hazard effects when implementing DI may cause large monetary losses and destabilize a country's financial system.

This paper aims to extent literature on the relation between deposit insurance and moral hazard in two ways. First, most empirical evidence uses U.S. data (as noted by Gopp and Vesala, 2004) or relies on samples of developed and developing countries pooled together. For example, Angkinand and Wilhborg 2010 analyzes how government foreign ownership and shareholder rights affect the disciplinary effect of partial deposit insurance systems in a cross-section analysis of industrial and emerging market economies. Demirgüç-Kunt and Detragiache (2002) use a sample of 61 developed and developing countries and find that explicit deposit insurance increases the likelihood of a banking crisis.

The problem with this type of pooled datasets is that this economies are at different levels of financial liberalization and sophistication. There are other few studies that use data from emerging markets at the cross-country level (Demirgüç-Kunt and Huizinga, 2004; Brown and Dinç, 2005; Apanard and Class, 2010). Our paper extends the cross-country analysis to single-country using institutional level data from an emerging market economy, namely Ecuador. We are therefore able to control for the heterogeneity[4] that arises from pooling different countries in a single dataset. Second, most of the research on deposit insurance has been directed towards the private banking industry. In this paper, we aim to extend the analysis to the Cooperative Financial industry; specifically to Credit Unions (CU). The CU industry provides a unique setting to study moral hazard issues related to DI because of these institutions' legal ownership form and regulatory environment[5].

It is important to mention that even without DI there are incentives for moral hazard. The limited liability business structure (through ownership of stocks) of most

3. Cooper and Ross (2002) explain moral hazard as a result of deposit insurance implementation, which reduces monitoring and show that capital requirements can mitigate moral hazard effects. Saunders et al. (1990) studied how risk-averse managers may limit risk-taking behavior. Benston et al. (1986) argued that monitoring from uninsured depositors and equity holders constrain risk-taking behavior through the threat of higher funding cost.
4. By heterogeneity we mean different level of financial sophistication and liberalization, different legal system, different political environment, etc.
5. For relationship of ownership type and the risk-taking incentives of deposit insurance see Karels and McClatchey (1999).

of the banking systems around the world establishes a limit on payments as a result of the failure of a bank (i.e., equal to the amount that is obtained after liquidating all the bank's asset) but establishes no limits on earnings. Thus creating incentives for channeling depositors' funds into risky investments opportunities. The only limit to this propensity to incur in risky behavior is the higher premium that has to be offered to depositors in order to attract more funds[6]. However, given important institutional differences with respect to the private banking industry, the credit unions industry is only partially affected by the issues described above. In this sector owners play an important role as much as management.

On the contrary to private banks, where there is a clear legal difference between the owners (stock holders), depositors and borrowers, in a CU each member is an owner, a depositor, and a borrower at the same time. Though, depending on the difference between their savings and loans balance, members can be categorized as either "net borrowers" or "net saver". A conflict of interest may exist if the CU is controlled by the "net borrowers" group. In this case, managers will be naturally inclined to hold a riskier loan portfolio acting against the "net borrowers" group interest[7]. As we can see, although arising from different causes than in the private banking sector, moral hazard can also arise in the CU sector even before deposit insurance is introduced.

With DI the situation is similar than the one described above for the banking sector, cooperatives will increase their risk-taking behavior because market discipline is reduced. Monitoring from net savers is eliminated and higher premiums to compensate for excessive risk are not required anymore.

Empirical literature on the moral hazard effects of deposit insurance in the credit unions sector provides mixed results. Kane (1989), McKenzie et al. (1992) and Cole (1993) suggest that moral hazard behavior was responsible for a significant portion of the Savings & Loans losses in the U.S, during the 1980's. Grossman (1992) studies U.S. thrifts in the 1930's and finds that insured thrifts are inclined to take more risk in a permissive regulatory system. Wheelock (1993) ad Thies and Gerlowski (1989) find a positive and significant relationship between deposit insurance and bank failure rates. Wheelock and Wilson (1995) provide evidence for the relation between moral hazard and risk-taking behavior of U.S, credit unions in the 1990's. Conversely, Whhelock and Wilson (1994), Alston et al. (1994) and Karels and McClatchey (1999) fail to find such relation.

6. As explained above, this type of market discipline is actually eliminated with the introduction of DI.
7. Another possibility is that CU's lending rates do not accurately reflect their asset portfolio risk.

To the best of our knowledge, there is only one previous paper that studies deposit insurance effects on risk behavior in the Ecuadorian financial system. In Perez and Ruiz (2015), the authors focused their analysis on the private banking sector[8]. This paper departs from their analysis in two ways. First, instead of using aggregated data from private banks, we use a panel dataset of 34 CU for a period of eight years. Second, our econometric methodology is different.

This paper uses non-parametric tests and panel data methods in order to test whether Ecuadorian credit unions have increase their risk-taking behavior as a result of the introduction of deposit insurance in 2009. Nonetheless, we think it is worth mentioning that both papers share the same motivation for using the Ecuadorian financial system as our object of study. As explained in Perez and Ruiz (2015), Ecuador offers a unique economic environment to study the relationship between DI and moral hazard because it has a dollarized economy since 2000[9]. Under dollarization, Ecuador, through its central bank, cannot make use of conventional monetary policy in order to stabilize the economy. Moreover, under constitutional mandate, neither the central bank nor any other public institution can act as the lender of last resort[10]. This situation makes it imperative for the country to have a strong financial system to promote economic development and growth. Another important reason to focus our analysis on Ecuador is that its deposit insurance system was implemented in early 2009. Having a relatively young DI system allows us to overcome many of the problems related to data availability in developing countries. Thus, we are able to use financial data to analyze risk levels between the pre and post deposit insurance periods in the CU sector.

The remainder of the paper is organized as follows. Section 2 provides a brief historical background of how cooperativism has evolved in Ecuador. In section 3 we explain the current economic and regulatory environment in which credit unions work in Ecuador. Section 4 presents a simple example to explain how moral hazard can arise in an economy with or without deposit insurance. Section 5 describes the dataset we use and provide some summary statistics. Section 6 presents the methodology and empirical specification. Results are reported in section 7. Section 8 examines the robustness of our results and section 9 concludes.

8. Perez and Ruiz (2015) use aggregate financial statements (i.e., balance sheet and income statement) data from 26 private Ecuadorian banks.
9. The Ecuadorian economy was officially dollarized on March 13th, 2000 when President Gustavo Noboa signed the "dollarization law".
10. The current Ecuadorian constitution was officially approved by a referendum on September 28th, 2008. It explicitly prohibits the government and its institutions to bail-out financial institutions.

II. COOPERATIVISM IN ECUADOR: A BRIEF HISTORICAL BACKGROUND

In general, cooperatives are non-profit organizations whose members voluntarily join and usually share common economic, social, and cultural bonds. These organizations are jointly owned and democratically controlled by their members who elect their board of directors in a one-person-one-vote system.

More specifically, Credit Unions are financial institutions owned and controlled by their members, based on cooperativism principles[11]; those who have an account in a CU are its members and owners. Contrary to private banks, CU are non-for-profit financial intermediaries that primarily provide services (i.e., accepting saving deposit and making loans) to their members. These type of cooperatives are indivisible and any accumulated capital is reinvested in itself.

Historically, cooperativism was born in Europe in mid-19th century. The first successful cooperative enterprise, the Rochdale Society of Equitable Pioneers, was founded in 1844 with the purpose to provide better living and working conditions to industrial workers[12]. Around the same time, the first financial cooperative was founded in Germany by Friedrich Wilhem Raiffeisen and Hermann Schulze-Delizch. By early 20th century, the concept of financial cooperatives crossed the Atlantic first to Canada in 1900 and later to the United States in 1908.

In Ecuador, the cooperativism started to take its current form in early 1900's. In 1937, the "Law of Cooperatives" was enacted in order to legally recognize the indigenous cooperative system that existed at the time. Under this law, cooperatives were categorized in two groups: (1) productive cooperatives and (2) saving and loans cooperatives (CU). The latter were identified as financial support providers for the productive (agricultural) sector. The law's main objective was to recognize and implement the cooperativism model as an instrument to reduce the socio-economic inequalities effecting agricultural rural areas. In 1961, the National Cooperative Directorate was created with the objective to monitor this sector as well as to promote and to educate about it; and in 1971, the Ecuadorian Cooperative Institute was created to support with its promotion and coordination.

11. The most widely recognized contemporary set of cooperative principles is that sanctioned by the International Cooperative Alliance (ICA). For a list of these seven principles see Zeuli and Cropp (2004) pp. 45.
12. Textile workers founded the Rochdale Society of Equitable Pioneers in 1844 in Rochdale, England.

Ecuadorian financial cooperatives, specifically CU, were classified in two groups: (1) "close" cooperatives and (2) "open" cooperatives. The former restricted their membership only to people that share a specific common bond (e.g., same profession, same working place, be part of the same organization, etc.). In the latter, any person that wished to open an account can do it as long as the person voluntarily wanted to do so and met certain legal requirements. As the number of financial cooperatives increased in Ecuador, there were many legal and administrative changes that affected this sector. An important one happened in 1984 when the Superintendence of Banks and Insurance Companies (SBS) proceeded to intervene and regulate most of the "open" CU of the time[13] ("close" cooperatives were under supervision of the Social Wellness Ministry). Under SBS's supervision, the credit unions industry implemented prudential policies that helped avoiding solvency issues and increased information transparency. This new regulatory environment not only helped CU to become more competitive compared to private banks but also helped them to overcome the 1999 financial crisis without major issues. As Jacome and Ruiz (2013) point out, these institutions could preserve members' deposits because they showed strong liquidity ratios, had good capital composition, and were better protected against credit risk. In fact, as Miño (2013) shows, a large number of CU were created between 1989 and 2006 as a response to the crisis of 1999 when twenty private banks went bankrupt.

III. A NEW SOCIAL AND SOLIDARY ECONOMIC SYSTEM

The current Ecuadorian constitution[14] defines for the first time a new social and solidary economic system. As such, it recognizes three different economic sectors: private, public, and (the new) popular and solidary. It is important to mention that this formal constitutional recognition allowed for the creation of a body of laws and institutions to supervise and regulate this new economic sector.

The popular and solidary economic sector can be subsequently divided into (1) a popular and solidary financial sector and (2) a popular and solidary real sector. Under this new economic framework, CU become part of the popular and solidary sector and fall into the first category listed above. As previously mentioned, CU are non-for-profit institutions which main objective is to provide financial services to low-income population. Traditional private banking institutions are usually reluctant to provide services to poor people and CU fill this void. For this reason, credit unions

13. There were 39 CU that were formally recognized as financial institutions in Ecuador with this legal change.
14. Approved on December 31st, 2008.

are seem as an alternative channel to bring economic development to low-income groups (e.g., micro businesses, low-income population, small enterprises, etc.).

In 2008, the global financial crisis and its contagious effects revealed the necessity to change the focus on ex-post supervision towards a risk-based preventive regulation. In consequence, the Ecuadorian government created the "Financial Safety Net (FSN)"[15] with the objective to minimize risks associated to economic crisis. The FSN is based on four fundamental pillars for economic stability: (1) prudential regulation and supervision, (2) lender of last resort, (3) banking resolution mechanism, and (4) deposit insurance. The scope of this paper is related to pillar four and its effect over risk levels in the Ecuadorian CU sector.

Accordingly, a deposit insurance system was implemented to cover deposits from private banks and credit unions that were supervised by the SBS. The Deposit Insurance Corporation (COSEDE) is the public institution that manages the insurance system. The amount covered under the insurance has grown up from USD 20,000 in 2009 to USD 32,000 in 2015 per deposit account. On May 2011, COSEDE extended the DI coverage to the Popular and Solidary sector as mandated by the "Law of the Popular and Solidary Economy (LPSE)"[16].

The new law also created the Superintendence of Popular and Solidary Economy (SEPS) that is intended to control and supervise institutions (financial and no financial) that belong to the new economic sector. Thus, the SEPS became the institution legally mandated to control and supervise the 39 S&LC that were until then under SBS supervision; however, this supervisory change was not effective until January 2013. As mentioned above, deposits in financial institutions that are under the SEPS supervision are also insured by COSEDE. Depending on the size (in terms of assets) of these financial institutions, the maximum amount insured is either USD 1,000 or USD 11,000.

According to SEPS (2016), as of December 2015 there are 848 credit unions categorized in five segments according to their total assets. More than 82% of these belong to the smallest segments 4 and 5 (with less than USD 5 million in total assets) accounting for 16% of the 5,531,047 members in the system. CU in the biggest segments 1 and 2 (with more than USD 20 million in total assets) represent less than 7% of the 848 CU but account for 69% of members in the system. Table 1 shows an overall picture of the popular and solidary financial sector as of December

15. The Spanish translation is "Red de Seguridad Financiera" and it was created in 2008.
16. In Spanish, "Ley Orgánica de Economía Popular y Solidaria (LOEPS)". This law created the legal framework under which the new economic sector, recognized in the constitution, has to operate.

2015. This table includes information on the number of institutions, the number of members, and the total amount of loans for each of the five segments. Table 2 below, compares the popular and solidary financial sector (PSFS) against the private banking financial sector (PBFS). As we can see, private banks accounts for 77.8% of total assets in the Ecuadorian financial system (i.e., PBF is more than three time bigger than PSFS).

In terms of liabilities, credit unions hold USD 7,359.8 million that represent 21.1% of total liabilities in the system. From 2013 to 2015, assets in the cooperative financial sector has grown three times faster than private banks' assets at an average 6-months rate of 6.4%.

Table 1: Popular and Solidary Financial Sector overall picture as of Dec. 2015

Segment	Institutions		Members		Loans	
	Number	%	Number	%	USD millions	%
1	25	2,9	2.561.480	46,3	4.122,4	67,5
2	34	4,0	1.253.155	22,3	1.022,7	16,8
3	87	10,3	831.574	15,0	658,3	10,8
4	188	22,2	579.606	10,5	234,8	3,8
5	513	60,5	323.232	5,8	65,7	1,1
Total	847	100,0	5.531.047	100,0	6.103,9	100,0

Source: reproduced by authors from "Rendición de cuentas 2015" SEPS (2016)

Table 2: Comparison between financial cooperatives and private banks
(2013–2015)
(in millions of U.S. dollars)

Account	Sector*	Dec. 13	Dec. 14	Dec. 15	Avrg. 6-months growth rate
Assets	PSFS	7.107,3	8.061,8	8.801,4	6,4
	PBFS	30.738,4	33.619,1	30.864,1	2,1
Liabilities	PSFS	6.059,2	6.873,7	7.359,8	6,1
	PBFS	27.829,3	30.483,7	27.567,6	1,9
Equity	PSFS	1.048,1	1.188,1	1.341,1	7,7
	PBFS	2.909,1	3.296,5	3.296,5	4,7

* PSFS: Popular and Solidary financial sector; PBFS: Private Banking Financial Sector
Source: reproduced by authors from "Rendición de cuentas 2015" SEPS (2016)

This paper focus its analysis on the cooperative financial sector because of its growing importance in the Ecuadorian economy. As we can observe in Tables 1 and 2, this sector provides financial services to one-third (33.89%) of the Ecuadorian population[17] and has grown at a higher rate than the private banking industry during the last years. Also, financial data from, at least, the 39 CU previously under SBS supervision is not only easily available but goes back to the period before deposit insurance was implemented in 2009. This allows us to study the effects of DI on risk-taking behavior of these institutions.

IV. A BRIEF EXAMPLE ON HOW MORAL HAZARD MAY BE AN ISSUE IN A BANKING SYSTEM

In this section we provide a simple example that allows us to explain how moral hazard may arise when financial institutions, specifically banks and credit unions, face investment decisions that do not necessarily align with depositors' best interest. We present the case with both deposit insurance and without it. The example is as follows:

Let's consider an economy with a single bank and no deposit insurance. The bank pays an interest rate (i) on deposits which represent 100% of its funding (no equity). There are two available investment opportunities, assets A and B, and the bank can invest in only one of them. Total investment $I \leq D$ is.

There are two possible states of the economy with probability of occurrence $p = 1/2$. Table 3 shows the payment schedule for each asset depending on the state of the economy. The investment horizon is 1 year. As we can see, investing in asset A is more efficient given that its expected return is higher than the expected return of asset B, $E(r_A) > E(r_B)$ and asset A's associated risk is lower than asset B, $(\sigma_A < \sigma_B)$. Now let's assume the bank's main objective is to maximize profit and that there is no minimum capital requirement (i.e., the total amount of deposits can be invested). Then, the bank will invest the amount of $(I = D)$.

To simplify this example, we also assume an interest rate on deposits of $i = 4\%$. This means that depositors expect a return of $E(r_D) = 0{,}04(D)$. With all previous information, we can now construct a profit schedule for the bank. According to Table 4, asset B offers a higher expected profit than asset A.

17. As of December of 2015, there are 16,320,179 people living in Ecuador and the cooperative financial sector has 5,531,047 members.

Table 3: Payment schedule for assets A and B, one year horizon

Asset	State	Probability	Rate of return	Expected return
A	1	1/2	5%	1.1(I)
	2	1/2	15%	
B	1	1/2	-40%	0.95(I)
	2	1/2	30%	

Table 4: Profit schedule for bank, one year horizon

Asset	State	Expected return	Cost	Profit	Expected profit
A	1	5%	4%	1%	0.06(I)
	2	15%	4%	11%	
B	1	-40%	4%	0*	0.13(I)
	2	30%	4%	26%	

* In this case the bank goes bankrupt. Depositors bear a loss of USD 40.

At this point we can see how moral hazard can arise in this economy. As the bank seeks to maximize profit, it will choose to invest in asset B because this asset offers a higher expected profit than asset A (even when asset A offers a higher expected return and lower risk than asset B). When choosing asset B, the worst case scenario is state 1 (with $p = 1/2$). In this situation, the bank goes bankrupt and depositors have to bear the loss; depositors will get back only 60% of their money. On the other hand, if state 2 happens, the bank will make a profit of 26%. Under information asymmetry (i.e., depositors do not have information about the bank's investment options), depositors put their money in the bank expecting to receive a return of 4% but do not expect a risk of losing 40% of these funds with probability $p = 1/2$ (moral hazard).

If depositors have information (no information asymmetry) about the bank's investment opportunities, the market will be inactive[18]. In this case, depositors will expect that the bank, as a profit maximizer, will invest in asset B. They know that in the worst case (state 1) the bank will go bankrupt (insolvent) and will be able to repay only 60% $(0.6D)$ of deposits. In the best case (state 2), the bank will pay the promise interest rate of 4% and depositors will receive

18. See Akerlof (1970), "The market for "Lemons": Quality Uncertainty and the Market Mechanism" for an explanation of how markets can degrade in the presence of information asymmetry.

$(1{,}04 * D)$ Depositors' expected return is then $(0{,}82D < D)$. Thus, depositors will prefer to keep their money at home and there will be no business for the bank.

If we introduce deposit insurance in this economy, depositors will be guaranteed to receive the promise rate of return of 4%; thus getting back $(1{,}04D)$ with no risk[19]. From depositors' perspective, it does not matter what investment choices the bank makes, they will still provide their funds. However, the bank now shifts the risk of loss towards the insurer (moral hazard). The bank will still choose asset B over asset A and the insurer would face a loss of $(0{,}44D)$ with probability $p = 1/2$Normally, this probable loss need to be covered by insurance premiums or other funding mechanisms. With deposit insurance the inactive market issue is solve but the bank's inefficient investment is not[20].

V. DATA

This paper uses a panel dataset formed of a cross-section of 34 CU and a time series from December 2007 to July 2015. We require institutions to have financial data available for at least one year before DI was implemented in 2009 and until at least four years after. For this reason out the 39 CU under SBS supervision until 2012, four institutions are excluded from our sample. It is important to mention that we use this group of institutions because under SBS supervision, they were required to collect and submit financial data under international banking standards, assuring data availability and transparency. Thus, variables in our data correspond to monthly financial statements (i.e., balance sheet and income statement accounts) reported to the SBS by financial institutions included in our sample. We use this information to compute our risk proxy variables (financial ratios) and other variable (e.g., dummy variables, trend, code, etc.) to be used in our econometric models. This process yields a sample of 1,366 variables with 3,113 observations each. Table 5 shows some descriptive statistics from main variables used in the paper during the sample period.

The monthly average amount of total assets for this group of financial cooperatives was USD 84.12 million with a growth rate of 1.43% per month. The monthly average amount of total liabilities was USD 71.53 million with an average growth rate of 1.43% during the sample period. Insured deposits amounted to USD 61.7 million and represented on average 93.7% of all deposits in the group.

19. Depositors' risk of loss is effectively eliminated with deposit insurance.
20. This inefficient investment issue may be solve by imposing a minimum capital requirement that is analog to a deductible in insurance contracts. The higher this minimum capital requirement, the smaller is the moral hazard problem.

Throughout the sample period, credit unions obtained positive net gains on average of USD 662 thousand per month.

Also, we have grouped credit unions in the sample as BIG and SMALL in terms of their size.

Table 5: Descriptive statistics for main variables in dataset (Dec. 2007 – Jul. 2015)

Variable	N	Mean	Min.	Max.	Std. Dev.
Capital adequacy ratio 1	3.113	0,092	0,012	0,440	0,063
Capital adequacy ratio 2	3.113	0,074	0,010	0,329	0,048
Capital adequacy ratio 3	3.113	0,043	0,005	0,295	0,037
Capital adequacy ratio 4	3.113	0,072	0,008	0,329	0,047
Loan delinquency ratio	3.113	0,057	0,011	0,342	0,038
Liquidty ratio 1	3.113	0,103	0,023	0,317	0,041
Liquidty ratio 2	3.113	-0,159	-1,269	0,409	0,214
Liquidty ratio 3	3.113	0,191	0,012	0,503	0,071
Financial risk	3.113	0,182	0,099	0,554	0,068
Operating risk	3.113	0,758	0,434	0,896	0,069
Leverage risk	3.113	5,011	0,806	9,061	1,556
Diversification	3.113	0,108	0,007	0,808	0,082
Percentage change in total assets (%)	3.113	1,428	-10,106	15,118	1,939
Percentage change in total liabilities (%)	3.113	1,426	-6,605	13,035	1,640
Insured Deposits (USD 1,000)	3.113	61.714,23	1.280,96	769.421,70	87.092,55
Insured Deposits/Deposits	3.113	0,937	0,569	1,000	0,064
Total assets (USD 1,000)	3.113	84.128,92	2.479,26	896.068,30	105.334,40
Total liabilities (USD 1,000)	3.113	71.534,39	2.020,50	791.809,20	92.996,80
Total equity (USD 1,000)	3.113	12.594,53	454,83	104.259,10	12.606,60
Deposits/Assets	3.113	0,669	0,270	0,868	0,107
Net Income (USD 1,000)	3.113	662,79	(1.874,99)	7.726,06	864,86

Note: for variables definitions see Table 6

In order to create these groups, we calculate the quartiles of the variable size[21] on January 2009, the DI implementation date. Then, we assign each CU to its corresponding quartile. The BIG group is composed of CU from the 4th quartile (ten

21. This variable is the ratio of each CU total asset over aggregate total assets for all 34 credit unions.

in total) and the SMALL group includes all the other CU (the other twenty-four)[22]. Appendix 1 presents the summary statistics for each group in order to compare their differences. In 2009, big CU held 62.23% of all the assets held by the group; decreasing by a small amount to 61.9% by the end of the sample period. The biggest credit union, JEP, held 16.6% of the group's total assets; failure of this or any other CU in the BIG group can have a devastating effect over the financial cooperative industry and to the deposit insurance system.

VI. EMPIRICAL METHODOLOGY

This paper uses non-parametric tests and panel data methodology in order to analyze the moral hazard effects of deposit insurance in a group of Ecuadorian credit unions. We use non-market measures of risk-taking behavior (i.e., financial ratios from financial statements) because in Ecuador neither private banks nor credit unions are publicly traded.

Table 6: Risk Variables: definitions and expected effects

These financial indicators are used as dependent variables in our regression analysis. We use these ratios to test whether risk levels have increased in the Ecuadorian Credit Union industry after deposit insurance was implemented on 2009. The first column lists the different classification of indicators we use. The second column presents the actual ratios and their definition. The last column shows the sign of the normalized time trend coefficient that we expect to observe from the regression analysis as evidence to support an increase in CU's risk-taking behavior.

Group:	Financial indicator:	Expected signed of normalized time trend*
Capital adequacy	Financial risk (FR): equity over assets CA1: total capital over total loans CA2: total capital over total assets	negative
Loan delinquency	LD1: loans delinquent 2 months or more/ total loans	positive
Liquidity	LR1: cash & due from banks / total assets LR2: 1-(total loans / deposits) LR3: 1-(total loans / total assets)	negative
Other commonly used	Operating risk (OR): net loans over assets Leverage risk (LevR): liabilities over equity	positive positive
Robustness indicators	CA3: legal reserves over total assets CA4: total reserves to total assets DM: diversification measure	no effect negative negative

* The normalized time trend takes the value of 0 for observations before January 2009. It equals 1 for January 2009
Source: replicated from Perez and Ruiz (2016)

22. The list of all credit unions used in this paper can be found in Appendix 1 as well as their classification (BIG or SMALL).

Following Perez and Ruiz (2016), we use five capital ratios in addition to three liquidity risk measures and two other ratios commonly used in literature of this topic[23] as our proxies for risk. Table 6 provides a complete list of the capital, liquidity and risk measures used in this paper as well as their definition and classification[24]. Using CU's financial statement data, we have constructed these dependent variables and have grouped them as follows: (1) capital adequacy; (2) loan delinquency; (3) liquidity; (4) other financial indicators commonly used; and (5) indicators to be used in our robustness analysis.

The third column in Table 6 shows the expected sign for the normalized trend coefficient used in our econometric models (see below). We are especially interested in the sign of this coefficient because it helps us to develop a hypothesis regarding the risk-taking behavior and capital choices by Ecuadorian CU following the implementation of DI. Intuitively, CU can exploit deposit insurance by increasing risk and/or decreasing capital ratios once DI is implemented.

Therefore, the hypothesis this papers tests is:

H_0: *CU risk measures increased and/or capital ratios meaures decreased following the implementaion of deposit insurance in Ecuador in* 2009.

To test this hypothesis, we first use a non-parametric median difference test for all the risk measures before and after January 2009. The median difference test used in the paper is the Wilcoxon non-parametric rank-sum test. The null hypothesis of this test is that two independent samples (i.e., unmatched data) are from populations with the same distribution[25]. Then, we use the following reduced form models that link proxies of CU's risk and capital ratios to a time trend variable. In order to control for firm specific and macroeconomic determinants, we also include some control variables.

$$risk_{i,t} = \beta_0 + \beta_1 trend_t + \sum_{j=2}^{M} \beta_j X_{j,i,t} + \varepsilon_{i,t} \qquad (1)$$

Where $risk_{i,t}$ is the financial indicator for CU i used to measure risk at time t; *trend* is a normalized time trend that takes the value of 0 for observation before January 2009, equals 1 for January 2009, and increases by one unit thereafter; $X_{j,i,t}$

23. These ratios are commonly used in deposit insurance literature as our measures of risk. See Table 6 for definitions.
24. We follow Karels and McClatchey (1999) classification of these indicators.
25. Also known as the Mann-Whitney two-sample test. See Wilcoxon (1945); Mann and Whitney (1947) for more details.

is the j^{th} control variable determining the CU *i* risk at time *t*; $\varepsilon_{i,t}$ is a stochastic error term; and β_0 to β_M are the usual regression coefficients.

$$CAP_{i,t} = \alpha_0 + \alpha_1 trend_t + \sum_{j=2}^{M} \alpha_j Y_{j,i,t} + \mu_{i,t} \quad (2)$$

Where $CAP_{i,t}$ is the capital ratio for CU *i* at time *t*; *trend* is the same as in model (1); $Y_{j,i,t}$ is the j^{th} control variable determining the CU *i* capital ratio at time *t*; $\mu_{i,t}$ is a stochastic error term; and α_0 to α_M are the usual regression coefficients. A positive and significant *trend* coefficient in equation 1 (significant and negative for liquidity risk ratios) and a negative and significant trend coefficient in equation 2 will provide evidence to support the main hypothesis of this paper (H_0 above).

To control for the impact of changing economic conditions and cyclical fluctuations, we have included the percentage change in assets and its lag as independent variable. Month dummies are also included in the model in order to control for the seasonality of deposits and other macroeconomic changes. All this control variable are included in $X_{j,i,t}$ and ,$Y_{j,i,t}$ respectively. The variable size is included to control for the heterogeneity of the amount of assets each CU holds in our sample.

Risk can be measure through capital adequacy ratios because of how total capital is composed. Although reserves reflects capital determined by regulation, the amount of retained earnings held is completely under managerial discretion. CU's managers would use retained earnings as an extra safety in a system without DI. Conversely, managers could replace this safety for insurance payments in case DI is implemented, effectively shifting risk towards the insurer. Thus changes in retained earnings are expected to reflect effects on risk behavior.

Capital risk can also be measure by the ratio of equity to assets (financial risk ratio in Table 6). Chernykh and Cole (2011) use this ratio, along with the ratio of bank loans to assets (operating risk), to examine the benefits and cost of deposit insurance in the Russian banking system. Gropp and Vesala (2004) use the leverage risk (liabilities to assets) ratio as another risk measure. As explained by this authors, this ratio measures the degree of gearing of the bank [CU]; the more highly geared a bank [CU] is, the riskier it is, as its cushion against an unexpected deterioration in the quality of its assets is smaller than in a less leveraged bank [CU]. This ratio is also used in this paper.

Asset risk can be proxy by the loans delinquency ratio. This paper defines this ratio as the proportion of delinquent loans[26] in the CU's loan portfolio. With deposit insurance, depositors trust in the system increases, as reflected by an increase in deposits. With more deposits, CU have more funds to issue more loans. Having a bigger loans portfolio increasing the probability of a higher proportion of problematic loans, thus increasing asset risk.

Banks with lower liquidity face higher risk in the case depositors demand their money back suddenly. As deposit insurance eliminates the probability of these sudden withdrawals, banks are able to hold more long-term assets that pay higher returns by decreasing liquidity. However, keeping low liquidity ratios for long times may increase the risk of insolvency.

VII. RESULTS

Monthly risk and capital ratios are calculated from 34 CU's financial statements reported to the Ecuadorian Superintendence of banks between Dec. 2007 and Jul. 2015. Results from the mean difference non-parametric test on all our capital and risk ratios are reported in Table 7. In panel A we test the hypothesis whether there is a statistical significant median difference, for each of our ratios, between the period pre DI and the period post DI (whole post period).

As we can see, results show that all capital and risk ratios used in this paper have a statistical different median in these two periods. Regarding capital ratios results are mixed. CA1 to CA4 medians are higher in post DI period (Jan. 2009 – Jul. 2015) than those in the pre DI (Dec. 2007 – Dec. 2008), increasing from 0.08 to 0.09 (CA1); from 0.069 to 0.074 (CA2); from 0.029 to 0.045 (CA3); and from 0.067 to 0.072 (CA4), respectively. This results are contrary to our hypothesis of higher risk-taking behavior. However, we observe that our variable financial risk (the last capital ratio) median actually decreased from 0.19 to 0.17, thus providing some evidence that risk increased between these two periods. For liquidity ratios, we expect their median to be lower in the post DI period. Results show that all three liquidity risk measures have a higher and statistically different median in the post DI period than in the pre DI period. The other four risk measures behaved as expected with the exception of the operating risk ratio that decreased from 0.77 to 0.75 between these two periods; The LD1 (delinquent loans) increased from 0.509 to 0.581; the leverage risk ratio increased from 4.4 to 5.07; and the diversification measure decreased from 0.13 to 0.03.

26. These are loans on default of interest and capital payments for two months or more.

Table 7: Non-parametric median difference test
between the pre DI and post DI periods
(2007 - 2015)

This table uses a sample of 34 Ecuadorian credit unions for which financial statements (i.e., balance sheet and income statement) was available over the period Dec. 2007 - July. 2015. Panel A shows results for the median difference non-paramentric Wilcoxon test between the pre DI period (Dec. 2007 - Dec. 2008) and the post DI period (Jan. 2009 - Jul. 2015). Panel B shows results for the same test as in panel A but in this case is between the pre DI period (Dec. 2007 - Dec. 2008) and the following post DI 2-year period (Jan. 2009 - Dec. 2010). All capital raios and risk measures are defined as in Table 6 above. P values are the probability associated with the test and can be interpreted conventionally.

Panel A: Non-parametric median difference test for the preDI period and the whole postDI period												
	CA1	CA2	CA3	CA4	LD1	LR1	LR2	LR3	fincrisk	operatrisk	leverisk	diversif
Z score	-3,673	-2,867	-13,440	-2,765	-6,091	-10,437	-9,653	-6,165	9,110	8,032	-8,971	10,779
P value	0,000	0,004	0,000	0,006	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,000
N1	442	441	441	441	442	441	441	441	441	441	442	442
N2	2685	2672	2672	2672	2685	2672	2672	2672	2672	2672	2685	2683
Panel B: Non-parametric median difference test for the preDI period and the following 2-year postDI period												
	CA1	CA2	CA3	CA4	LD1	LR1	LR2	LR3	fincrisk	operatrisk	leverisk	diversif
Z score	-3,122	-1,927	-5,621	-1,973	-5,545	-9,176	-5,161	-6,178	2,085	7,704	-2,148	5,810
P value	0,002	0,054	0,000	0,049	0,000	0,000	0,000	0,000	0,037	0,000	0,032	0,000
N1	442	441	441	441	442	441	441	441	441	441	442	442
N2	816	816	816	816	816	816	816	816	816	816	816	816

As mentioned above, all these results are statistically significant at the 1% level with the exception of CA2 and CA4 (both significant at the 5% level). The non-parametric median difference analysis provide mixed results about our hypothesis of increased risk following the implementation of DI in 2009. Results in panel B are similar to the one in panel A, in significance and direction.

With respect to our panel data regression analysis, it is important to mention that all regressions are corrected for first-order autocorrelation and report heteroskedastic robust standard errors. Also we decided to run both random and fixed effects regressions because Hausman test results[27] provided different conclusion on whether fixed effects are preferred over random effects. Estimation results for the capital ratios (i.e., CA1, CA2, and financial risk ratio) are presented in Table 8. Consistent with results obtained in the non-parametric analysis, Table 8 results are mixed. We can see that risk as measured by the financial risk ratio decreased between the pre DI and the post DI periods. The *trend* coefficient is negative and statistically significant as expected under our main hypothesis. However, DI implementation had no effect

27. See appendix 2 for a table with Hausman test results.

over capital levels as measured by our variables CA1 and CA2, suggesting that discretionary capital was not affected by DI.

Risk ratios regression results are presented in Table 9. CU in our sample had a higher level of leverage risk during the post DI period as compared to the period before 2009. This ratio coefficient is positive and significant as expected under our hypothesis. Loans delinquent ratio (LD1) is positive suggesting that CU loan portfolio was riskier in the post DI period; however this coefficient is not significant at any conventional level. The introduction of DI did not have any effect over operating risk as reflected by the *trend* insignificant coefficient.

Table 8: Capital Ratios regression results

This table presents regression results for the capital ratios (CA1, CA2, and financial risk) used as dependent variables. For each indicator, results in column (Random) were estimated using pnael data regressions with randon effects; and column (Fixed) results were estimated using panel data regressions with fixed effects. Both columns report heteroskedastic corrected standard errors.Monthly dummies were also included in the regressions in both cases (results are not reported due to space). The sample includes 34 Ecuadorian credit unions for which financial statements (i.e., balance sheet and income statement) was available over the period Dec. 2007 - July. 2015.

	Financial risk: equity over assets		CA1: Total Capital to Total Loans		CA2: Total Capital to Total Assets	
Variables	Random	Fixed	Random	Fixed	Random	Fixed
trend	-0.000532***	-0.000532***	0.0000649	0.0000656	0.0000317	0.0000324
	(0.0000)	(0.0000)	(0.5085)	(0.5079)	(0.7004)	(0.6968)
pctTA	-0.00143***	-0.00143***	-0.000514	-0.000511	-0.000785*	-0.000782*
	(0.0000)	(0.0001)	(0.1785)	(0.1901)	(0.0129)	(0.0184)
L.pctTA	-0.00147***	-0.00147***	-0.000610	-0.000608	-0.000767*	-0.000765*
	(0.0000)	(0.0001)	(0.1205)	(0.1316)	(0.0217)	(0.0285)
size	-0.270	-0.251	0.181	0.209	0.128	0.154
	(0.5162)	(0.5534)	(0.4184)	(0.3795)	(0.4246)	(0.3697)
Constante	0.212***	0.212***	0.0954***	0.0943***	0.0780***	0.0771***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
R-square		0.412		0.099		0.094
Observations	3041	3041	3041	3041	3041	3041

p-values in parentheses
* p<0.05; **p<0.01; p<0.001

Table 9: Risk ratios regression results

This table presents regression results for the risk ratios (Leverage risk, operaating risk, and loans delinquency risk) used as dependent variables. For each indicator, results in column (Random) were estimated using pnael data regressions with randon effects; and column (Fixed) results were estimated using panel data regressions with fixed effects. Both columns report heteroskedastic corrected standard errors.Monthly dummies were also included in the regressions in both cases (results are not reported due to space). The sample includes 34 Ecuadorian credit unions for which financial statements (i.e., balance sheet and income statement) was available over the period Dec. 2007 - July. 2015.

	Leverage risk: liabilities over equity		Operating risk: net loans over assets		LD1: Loans Delinquent 2+ months / Total Loans	
Variables	Random	Fixed	Random	Fixed	Random	Fixed
trend	0.0173***	0.0172***	-0.000213	-0.000209	0.0000964	0.0000931
	(0.0000)	(0.0000)	(0.1528)	(0.1676)	(0.3767)	(0.3848)
pctTA	0.0357***	0.0355***	-0.00344***	-0.00344***	-0.00245***	-0.00242***
	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0001)	(0.0006)
L.pctTA	0.0344***	0.0342***	-0.00163***	-0.00163***	-0.00255***	-0.00253***
	(0.0000)	(0.0001)	(0.0001)	(0.0003)	(0.0002)	(0.0009)
size	13.65	12.71	0.309	0.476	-0.653	-0.792
	(0.2498)	(0.3118)	(0.1919)	(0.1361)	(0.2377)	(0.3499)
Constante	3.934***	3.966***	0.757***	0.752***	0.0820***	0.0861***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0010)
R-square		0.423		0.062		0.113
Observations	3041	3041	3041	3041	3041	3041

p-values in parentheses
* p<0.05; **p<0.01; p<0.001

From Table 10 results we can see that the level of liquidity risk among the Ecuadorian CU in our sample increased during the post DI period. LR1 and LR2 *trend* coefficients are positive and significant at the 5% and 1% level respectively. LR3 trend coefficient is also positive but no significant. These results are contrary to what we expected under our main hypothesis.

Table 10: Liquidity risk ratios regression results

This table presents regression results for the liquidity risk ratios used as dependent variables. For each indicator. results in column (Random) were estimated using pnael data regressions with randon effects; and column (Fixed) results were estimated using panel data regressions with fixed effects. Both columns report heteroskedastic corrected standard errors.Monthly dummies were also included in the regressions in both cases (results are not reported due to space). The sample includes 34 Ecuadorian credit unions for which financial statements (i.e. balance sheet and income statement) was available over the period Dec. 2007 - July. 2015.

	LR1: Cash % Due from Banks / Total Assets		LR2: 1-(Total Loans / Shares & Deposits)		LR3: 1-(Total Loans / Total Assets)	
Variables	Random	Fixed	Random	Fixed	Random	Fixed
trend	0.000167*	0.000166*	0.00187***	0.00186***	0.000201	0.000196
	(0.0367)	(0.0464)	(0.0000)	(0.0000)	(0.1882)	(0.2021)
pctTA	0.00339***	0.00339***	0.00889***	0.00886***	0.00450***	0.00450***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
L.pctTA	0.000631	0.000630	0.00687***	0.00684***	0.00275***	0.00274***
	(0.1417)	(0.1524)	(0.0000)	(0.0001)	(0.0000)	(0.0000)
size	-0.185	-0.234	-0.519	-0.965	-0.0330	-0.211
	(0.3748)	(0.4153)	(0.6539)	(0.4283)	(0.9360)	(0.6714)
Constante	0.102***	0.104***	-0.226***	-0.212***	0.182***	0.187***
	(0.0000)	(0.0000)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
R-square		0.103		0.222		0.079
Observations	3041	3041	3041	3041	3041	3041

p-values in parentheses
* p<0.05; **p<0.01; p<0.001

Results from our panel data analysis offer mixed results about our main hypothesis. Overall, we observe than in most of the cases DI implementation had no effect on risk levels. However, we do observe that capital adequacy risk, as measured by the financial risk ratio, and leverage risk have increased since DI was implemented.

VIII. ROBUSTNESS

To check the robustness of our results, we use to different approaches. First, we use alternative risk proxies to test further test whether risk level increased among CU in our sample after DI was implemented. We propose two alternative financial ratios that ex-ante should not have been affected by the introduction of deposit insurance: (1) the ratio of legal reserves to assets and (2) the ratio of total reserves to assets. On the one hand, the legal reserves account is out of control of CU' managers thus we expect to find no effect from DI. On the other hand, although it includes a discretionary component, Ecuadorian CU total reserves are mainly composed of legal reserves. Second, we include the proportion of non-interest income of total income to measure CU' ability to diversify into non-lending and non-traditional

Table 11: Robustness test regression results

This table presents regression results for our robustness test. Capital ratios CA3 and CA4 and our diversification variable are used as dependent variables. For each indicator. results in column (Random) were estimated using pnael data regressions with randon effects; and column (Fixed) results were estimated using panel data regressions with fixed effects. Both columns report heteroskedastic corrected standard errors.Monthly dummies were also included in the regressions in both cases (results are not reported due to space). The sample includes 34 Ecuadorian credit unions for which financial statements (i.e. balance sheet and income statement) was available over the period Dec. 2007 - July. 2015.

	CA3: Legal Reserves to Total Assets		CA4: Total Reserves to Total Assets		Diversification: non-interest income over income	
Variables	Random	Fixed	Random	Fixed	Random	Fixed
trend	0.000386***	0.000387***	0.0000334	0.0000340	-0.000470***	-0.000468***
	(0.0000)	(0.0000)	(0.6769)	(0.6736)	(0.0000)	(0.0001)
pctTA	-0.000498***	-0.000497***	-0.000809**	-0.000807**	-0.000251	-0.000234
	(0.0000)	(0.0002)	(0.0061)	(0.0100)	(0.6373)	(0.6651)
L.pctTA	-0.000526***	-0.000525***	-0.000843**	-0.000841*	-0.000106	-0.0000889
	(0.0000)	(0.0000)	(0.0087)	(0.0133)	(0.8524)	(0.8766)
size	-0.196	-0.194	0.120	0.144	-0.208	-0.152
	(0.1628)	(0.1921)	(0.4492)	(0.3920)	(0.7361)	(0.8282)
Constante	0.0397***	0.0395***	0.0708***	0.0700***	0.152***	0.151***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
R-square		0.496		0.057		0.111
Observations	3041	3041	3041	3041	3038	3038

p-values in parentheses
* p<0.05; **p<0.01; p<0.001

activities. To some extent the ratio will proxy for CU' "innovation ability" as in Gropp and Vesala 2004. It is expected that as a bank diversifies its operations, its risk levels decrease. Robustness regression results are presented in Table 10. As expected, the CA4 *trend* coefficient is not significant at any conventional level. However, we observe legal reserves have increased during the post DI period as reflected by its *trend* positive and significant coefficient.

The increased level must have been caused by some regulatory or legal change, out of the scope of this paper. Finally, we can observe that Ecuadorian credit unions have decreased their diversification activities, suggesting an increase of their loans portfolios, thus increasing risk levels.

IX. CONCLUSION

Using non-parametric median difference test and panel data analysis, this paper studies the relation of moral hazard deposit insurance among a group of Ecuadorian credit unions. Results provide mixed evidence to support our main hypothesis that this group of credit unions increased their risk-taking behavior following the introduction of deposit insurance in 2009. In general, deposit insurance implementation had no effect on risk levels among these credit unions. However, we do find evidence that risk as measured by the equity to assets ratio increased during the post DI period. We also observe that CU increased their leverage risk levels as well as decreasing their diversification activities.

Some of our findings are consistent with the ones in Perez and Ruiz (2016), especially the one that suggest that mostly the implementation of DI had no effect over risk levels. However, while they find some evidence that risk levels decreased in the Ecuadorian private banking system, our results suggest something different. Although, as measured by most of our indicators, we found DI had no effect over risk levels, we do find some evidence that some risk has increased among the CU used in our sample.

This paper fails to find evidence for the relation between moral hazard and risk-taking behavior in line with Whelock and Wilson (1994), Alston et al. (1994) and Karels and McClatchey (1999).

While this paper is the first to investigate the DI moral hazard hypothesis in the Ecuadorian credit union industry, it suffers from some shortcomings. First, we only had 13 monthly observations for the pre DI period, which may not be enough to have a good picture of these CU risk-taking behavior before 2009. Second, more

control variables could have been included in the regression analysis in order to isolate the DI effect. However, common controls used in this topic's literature would have caused endogeneity issues with our panel data analysis. Finally, many previous studies on this topic use market risk data, which is not possible to find in Ecuador. Future research can perhaps use a different methodology that allows to use more control variables. We suggest using VAR analysis to avoid endogeneity issues.

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ANNEXES

Appendix 1

Variable	N	Mean	Min.	Max.	Std. Dev.
BIG					
Capital adequacy ratio 1	3.113	0.079	0.012	0.170	0.033
Capital adequacy ratio 2	3.113	0.061	0.010	0.126	0.027
Capital adequacy ratio 3	3.113	0.036	0.005	0.115	0.022
Capital adequacy ratio 4	3.113	0.059	0.008	0.119	0.027
Loan delinquency ratio	3.113	0.047	0.011	0.342	0.046
Liquidty ratio 1	3.113	0.111	0.025	0.244	0.041
Liquidity ratio 2	3.113	-0.026	-0.557	0.409	0.161
Liquidity ratio 3	3.113	0.236	0.012	0.503	0.080
Financial risk	3.113	0.150	0.099	0.265	0.029
Operating risk	3.113	0.721	0.434	0.893	0.078
Leverage risk	3.113	5.907	2.774	9.061	1.241
Diversification	3.113	0.091	0.007	0.402	0.064
Percentage change in total assets (%)	3.113	1.548	-9.529	8.309	1.745
Percentage change in total liabilities (%)	3.113	1.528	-6.414	13.035	1.573
Insured Deposits (USD 1.000)	3.113	143.718.10	18.225.31	769.421.70	122.909.20
Insured Deposits/Deposits	3.113	0.959	0.737	0.999	0.052
Total assets (USD 1.000)	3.113	188.171.80	42.764.96	896.068.30	141.680.80
Total liabilities (USD 1.000)	3.113	162.498.30	31.496.13	791.809.20	126.554.20
Total equity (USD 1.000)	3.113	25.673.46	8.105.11	104.259.10	15.393.65
Deposits/Assets	3.113	0.724	0.425	0.868	0.094
Net Income (USD 1.000)	3.113	1.274.59	-1.874.99	7.726.06	1.205.59
SMALL					
Capital adequacy ratio 1	3.113	0.097	0.019	0.440	0.070
Capital adequacy ratio 2	3.113	0.079	0.016	0.329	0.054
Capital adequacy ratio 3	3.113	0.047	0.006	0.295	0.041
Capital adequacy ratio 4	3.113	0.077	0.016	0.329	0.053
Loan delinquency ratio	3.113	0.061	0.011	0.216	0.033
Liquidty ratio 1	3.113	0.099	0.023	0.317	0.041
Liquidity ratio 2	3.113	-0.214	-1.269	0.197	0.209
Liquidity ratio 3	3.113	0.173	0.031	0.364	0.058
Financial risk	3.113	0.195	0.105	0.554	0.075
Operating risk	3.113	0.773	0.567	0.896	0.058
Leverage risk	3.113	4.643	0.806	8.515	1.523
Diversification	3.113	0.115	0.007	0.808	0.087
Percentage change in total assets (%)	3.113	1.379	-10.106	15.118	2.011
Percentage change in total liabilities (%)	3.113	1.385	-6.605	8.634	1.665
Insured Deposits (USD 1.000)	3.113	28.050.67	1.280.96	119.733.20	24.643.99
Insured Deposits/Deposits	3.113	0.928	0.569	1.000	0.066
Total assets (USD 1.000)	3.113	41.418.07	2.479.26	171.193.80	33.857.19
Total liabilities (USD 1.000)	3.113	34.192.60	2.020.50	148.569.30	28.921.97
Total equity (USD 1.000)	3.113	7.225.47	454.83	24.616.12	5.281.14
Deposits/Assets	3.113	0.647	0.270	0.816	0.104
Net Income (USD 1.000)	3.113	411.64	-1.409.77	3.599.65	492.02

Appendix 2: List of credit unions used in this paper		
No.	**Cooperative**	**Classiffication**
1	11 DE JUNIO	SMALL
2	15 DE ABRIL	SMALL
3	23 DE JULIO	SMALL
4	29 DE OCTUBRE	BIG
5	9 DE OCTUBRE	SMALL
6	ALIANZA DEL VALLE	SMALL
7	ANDALUCÍA	BIG
8	ATUNTAQUI	SMALL
9	CACPE BIBLIAN	SMALL
10	CACPE PASTAZA	SMALL
11	CACPECO	SMALL
12	CALCETA	SMALL
13	CHONE	SMALL
14	COMERCIO	SMALL
15	CONST COM Y PROD	SMALL
16	COOPAD	SMALL
17	COTOCOLLAO	SMALL
18	EL SAGRARIO	BIG
19	GUARANDA	SMALL
20	JARDÍN AZUAYO	BIG
21	JEP	BIG
22	LA DOLOROSA	SMALL
23	MEGO	BIG
24	OSCUS	BIG
25	P. JULIÁN LORENTE	SMALL
26	PABLO MUÑOZ VEGA	SMALL
27	PROGRESO	BIG
28	RIOBAMBA	BIG
29	SAN FRANCISCO	BIG
30	SAN FRANCISCO DE ASIS	SMALL
31	SAN JOSE	SMALL
32	SANTA ANA	SMALL
33	SANTA ROSA	SMALL
34	TULCÁN	SMALL

Appendix 3: Hausman test to choose between FE and RE

	CA1	CA2	CA3	CA4	LD1	LR1	LR2	LR3	fincrisk	operatrisk	leverisk	diversif
Chi-square	4.7107	4.8202	0.6561	4.5909	16.1709	1.8154	16.8248	8.2039	7.3445	9.8442	11.2282	1.3113
P value	0.0949	0.0898	0.7203	0.1007	0.0003	0.4034	0.0002	0.0165	0.0254	0.0073	0.0036	0.5191

Ho: Difference in coefficients not systematic
If Ho is rejected. FE is preferred over RE