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# Drivers of depositor discipline in credit unions

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## Abstract

In this paper, we analyze whether credit unions are subject to market discipline by their (member) depositors and examine the drivers of such discipline. We first provide descriptive evidence of depositor discipline in credit unions: shares and deposits as well as savings interest rates react to variables that reflect the financial health of the credit union and its asset risk. We show that this discipline is long-lasting and that it is mediated by the existence of a deposit guarantee scheme and by the strength of the relationship of members with the credit union. We then use proxies of the capability of members to process financial information to show that discipline is heavily influenced by member financial sophistication. Our results suggest that a type of market-based discipline acts as a complement for regulation in controlling credit union risk taking, thus contributing to overall financial stability.

KEYWORDS
bank–client relationship, credit unions, depositor discipline, financial literacy

JEL CLASSIFICATION
M41, G12

## 1 | INTRODUCTION

Market discipline of financial institutions is one of the pillars of the Basel Committee on Banking Supervision and it has been considered a key factor in reinforcing and supporting the effects of explicit regulation and supervision.[1] This market-based discipline is exercised by equity and debt markets, which have been shown to react negatively to risk-taking or to a worsening of the fundamentals of the financial institution. This negative reaction provides an incentive for the financial institution to control risk-taking and implement sound investment strategies. In the case of depository institutions, deposit markets are likely to represent a major source of market-based discipline and the literature has shown that bank deposits react to banks' risk-taking in ways suggestive of disciplining behavior. However, to our knowledge there is little evidence on whether or not depository discipline plays a role in monitoring other depositor institutions and, in particular, credit unions (CUs) or cooperative banks and, if so, on whether the mechanisms through which this discipline works are similar to those in play for banks.

The lack of evidence of depositor discipline in CUs may be a consequence of four specific characteristics of CU depositors that make them unlikely to behave in ways that imply a disciplining of the CU. First, CU members play the dual role of depositors and owners since their shares in the credit union are treated as deposits. Thus, owner-depositors may be less willing than otherwise to exercise strong discipline on the CU and might be more reluctant to withdraw their deposits even in the presence of significant risk-taking or worsening of CU fundamentals. Second, CUs have a defined field of membership (common bond) which limits the potential customers the CU can serve. This field of membership definition implies that the relationship of the CU with its members is, in general, closer than that of other financial institutions with their depositors and increases the relational-banking dimension of the CU–member relationship as well as the sense of ownership: both these effects would be expected to increase the reluctance to exercise discipline.[2] Third, the member base of most CUs is composed of savers/investors with lower levels of financial sophistication: around 47% of CUs had a low income designation in 2018, which meant that these CUs served predominantly low-income areas where financial literacy and sophistication may arguably be lower.[3] Thus, the ability of CU member/depositors to process financial information may mediate and significantly reduce the intensity of potential disciplining effects. Finally, most CU members are small savers/investors with deposit amounts below the limit insured by the National Credit Union Share Insurance Fund (NCUSIF) currently set at $250,000. Insured deposits are likely to be less responsive (or not at all) to CU information.

There are, on the other hand, several arguments in favor of the existence of active monitoring exercised by CU members and, as a consequence, of the possibility that, at least, some CU deposits react in a manner consistent with discipline.[4] In fact, the first two arguments outlined above can work in the opposite direction: since CU depositors are also the owners of the CU and have a tighter relationship due to field-of-membership, significantly lower asymmetries of information between CU management and members might facilitate the existence of a disciplining effect. Second, the value (net-worth) of a CU includes the present value of time and resources

[1] Bank for International Settlements, 2001. Pillar 3—Market discipline. http://www.bis.org/publ/bcbs_wp7.htm.

[2] See Brown et al. (2020).

[3] Source: call reports NCUA.

[4] This discussion draws heavily from Kane and Hendershott (1996) and from the limited available evidence of depositor discipline in Cooperative Banks and CUs (Murata & Hori, 2006, for Japan; Arnold et al., 2016, for Germany; Gómez-Biscarri et al., 2021, for the commercial lending activity of US CUs).

contributed by members and sponsors, who tend to be much more involved in the CU activities than, for example, bank depositors. These members and sponsors have an increased incentive to monitor conflicts of interest and risk-taking activities undertaken by managers (for example, when a sponsor is an employer, it may be required to cover losses on uninsured deposits: this potential liability reinforces its incentives to monitor the CU). Third, particularly in employer-sponsored or community CUs, sponsors and volunteers often have inside information about the credit history and earnings potential of loan applicants. This information makes shifts in lending strategies easier to identify and, given the close links of CU members, it may effectively get transmitted through various, maybe informal, channels. Fourth, CUs have a certain amount of "sophisticated" depositors/members, namely depositors with amounts beyond the insured limit, government deposits, brokered deposits, business share accounts and deposits by other CUs. Even though these represent a small fraction of total deposits, they are likely to be more actively engaged in monitoring the CU and more reactive to CU information. In the presence of such depositors, the less sophisticated depositors have been shown to follow the behavior of the leading deposits and react similarly (although with a lag: Davenport & McDill, 2006; Park & Peristiani, 1998).[5] Fifth, even though most CU members are likely not to be aware of or interested in the formal financial information of the CU, they are still exposed to channels where the financial and economic situation of the CU is described (print media such as newspapers and busines magazines, broadcast news through local radio and television channels, online newspapers, informal communication with local or business peers: Lamers, 2015). These alternative informational channels are likely to be more relevant in the case of CUs, given the tighter links generated by the field of membership. Finally, NCUSIF-insured CUs are coinsurers of one another: all CUs insured by NCUSIF are responsible for curing any shortage the fund might develop. This co-responsibility expands the effective size of the NCUSIF fund and it strengthens the incentives for CUs to cross-monitor one another and react to other CUs' risk-taking through changes in cross-CU loans and deposits (Kane & Hendershott, 1996).

The arguments outlined above suggest that the existence of CU deposit reaction to the CU risk-taking and fundamentals (i.e., the existence of depositor discipline in CUs) is, ultimately, an empirical question. In this paper we examine this issue and provide a descriptive view of depositor discipline in CUs. We use our preceding discussion as a framework for our analysis of depositor discipline in the US credit union sector. We attempt to understand whether there is indeed significant discipline exercised by CU members and how this discipline works. Specifically, we are interested in answering the following questions:

- Do CU members exercise discipline on credit unions with bad fundamentals or which have riskier balance-sheets?
- What factors (such as the strength of the CU–member relationship) affect the intensity of discipline exercised by CU members?
- How important is the role of member financial literacy in the disciplining of CUs?

We use a large panel of quarterly data of CUs which covers the period 1994–2018. Our analysis proceeds in several steps. We first test for the existence of depositor discipline using methodologies common to the market discipline literature (see Barajas & Steiner, 2000; Calomiris & Powell, 2001; Gómez-Biscarri et al., 2021; Maechler & McDill, 2006; Martinez Peria & Schmukler, 2001).

[5] In our sample, non-insured, government, brokered and business share deposits represent 5.20%, 0.24%, 0.3% and 2.03% of total deposits, respectively.

In particular, we relate deposit and member growth to a set of CU fundamentals and risk indicators while controlling for idiosyncratic factors and, to the extent possible, for unobservables: we expect that CU members withdraw or diversify their shares and deposits or abandon the CU when fundamentals deteriorate or the CU increases its risk-taking. We also look at the reaction of saving rates (interest on deposits and dividends on shares), where we expect to see an increase in saving rates when fundamentals deteriorate or the CU increases its risk taking. We then document how long-lasting (or slow) the discipline effect is and how it is mediated by the existence of a deposit insurance scheme and by differences in the strength of the relationship between the CU and its members. In the final part of our analysis we examine how financial literacy may be a determinant of the strength of depositor discipline.

Our results show strong evidence of a positive relationship between deposit growth and the quality of a CU fundamentals (profitability and net-worth) and of a negative relationship with risk-taking indicators (earnings volatility and the risk of the loan portfolio). Our results also show that the number of members reacts significantly to those variables. The analysis of saving rates shows heterogeneous results depending on whether those rates are on members or nonmembers deposits. All the above results are suggestive of the presence of depositor discipline mechanisms in CUs. Our next set of results describe in more detail these mechanisms. We show that discipline is mediated by the existence of the NCUSIF deposit insurance scheme: insured deposits react much less than uninsured depositors, though we still find evidence of a significant reaction of insured deposits (probably from diversification of further deposits rather than withdrawal of currently insured amounts). We then show that depositor reaction persists in time until two years after financial information is made available, a finding suggestive of a slow reaction of CU deposits and consistent with our motivating arguments. Regarding CU–member relationship, our results suggest that members of CUs with community or multiple fields of membership (react strongly to fundamentals in ways consistent with depositor discipline, whereas members of occupational and associational CUs do not react as markedly, especially with respect to credit risk indicators. Also, we show that alternative proxies for the strength of the relationship between a member and the CU are indeed correlated with deposit behavior. We argue that these results suggest that loyalty to the CU or the intensity of the CU–member relationship are important dimensions of the disciplining behavior. Finally, we provide evidence suggestive that indeed financial literacy is an important mediator of discipline, since more financially sophisticated members exercise stronger discipline on deposits.

Our results have important policy implications. First, understanding the way members react to CU strategies should be of help in the design of policies aimed at controlling CU risk taking. Second, given the special features of CUs, which differentiate them from other financial institutions, the disciplining mechanisms work differently and, therefore, regulation of credit unions and banks might need to diverge further. Finally, knowledge of the effect of financial sophistication on depositor discipline may help in the design of institutional efforts aimed at helping financial decision-making while understanding the impact of such policies on the stability of the overall financial system.

The remainder of the paper is organized as follows. In Section 2 we briefly review the literature on market discipline and credit unions, which we use, along with the arguments outlined in this introduction, to design our analyses. In Section 3 we describe our data. In Section 4 we show the main descriptive results on the mechanisms of depositor discipline, including persistence and the impact of deposit insurance schemes and proxies for the strength of CU–member relationship. In Section 5 we look at the impact of financial literacy. In Section 6 we review some robustness tests and in Section 7 we conclude by suggesting the main implications of our results.

# 2 | A LOOK AT THE RELATED LITERATURE

## 2.1 | Market discipline

Market discipline is a way of "self-regulation" exercised by certain bank stakeholders over the strategies and risk exposure of banks: if market providers of financing react to poor bank performance or bad bank fundamentals, banks have strong incentives to reduce excessive risk-taking and improve their investment strategies. This, in turn, should lead to increased stability of the financial system and an overall reduction in systemic risk (Arnold et al., 2016; Nier & Baumann, 2006). In depository institutions, this discipline may be exercised by the institution's owners, through equity markets, or by depositors. In fact, depositors may be especially effective in exercising discipline on institutions where deposits are the main source of financing, as is the case of banks—public and, especially, private—or credit unions. For this reason, most studies of market discipline on banks have focused on whether depositors—and other debt holders—effectively discipline banks and the channels through which this discipline is exercised: Ellis and Flannery (1992) and Flannery and Sorescu (1996) show how debt holders obtain premium yields on debt instruments from the riskier banks. Maechler and McDill (2006) and Park and Peristiani (1998) focus on depositors and show that there is evidence of depositor discipline via both increases in interest rates and decreases of deposit growth. Evidence of this disciplining effect has also been found in international contexts and, especially, during times of high financial instability: besides the US, evidence of market discipline has been found in Latin American countries (Barajas & Steiner, 2000, for Colombia; Calomiris & Powell, 2001, for Argentina; Martinez Peria & Schmukler, 2001, for Argentina, Chile and Mexico), Japan (Murata & Hori, 2006), China (Hou et al., 2016), Turkey (Aysan et al., 2017), Europe (Sironi, 2003; Hasan el al., 2013), Germany (Arnold et al., 2016) and Switzerland (Birchler & Maechler, 2002; Brown et al., 2020).

The existence of depositor discipline, namely the possibility that depositors actively react by withdrawing their deposits (or diversifying further deposits across banks) or demanding higher interest rates when risk-taking increases or the bank's fundamentals deteriorate, depends on three factors:

a. The prompt access of depositors to financial information about the bank, that is, on the extent of informational asymmetries between bank managers and depositors (Flannery, 1998; Hasan et al., 2013; Miles, 1995).
b. The ability of depositors to process this financial information and exert effective monitoring by reacting to signals of poor bank performance: Davenport and McDill (2006) analyzed the failure of Hamilton Bank in 2002 and showed that the most sophisticated depositors, such as business accounts, were significantly more sensitive to bank performance; De Ceuster et al. (2003) also showed that small and uninformed depositors tend to play a weaker role on market discipline.
c. The bank–client relationship: Brown et al. (2020) find evidence that the propensity of depositors to withdraw deposits from distressed banks is reduced by the intensity of the bank–client relationship. In particular, when banks provide their depositors with additional services like credit lines, payment processing, etc., the propensity of depositors to discipline the bank is significantly reduced. Also, Iyer et al. (2016) find that banks with otherwise identical balance sheets can have very different degrees of fragility depending on their relationships with depositors.

The three factors mentioned above are mediated by a final dimension of the bank-depositor relationship, namely the insurance of deposits. At the basic level of analysis, the existence of an insurance scheme would seem to reduce or eliminate the extent of depositor discipline by making insured deposits unresponsive to bad fundamentals (see, e.g., Birchler & Maechler, 2002; Goldberg & Hudgins, 1996, 2002; Hannan & Hanweck, 1988; Ioannidou & De Dreu, 2019; Iyer et al., 2016; Maechler & McDill, 2006; Martin et al., 2018).[6] Furthermore, uninsured deposits tend to belong to more sophisticated and more informed investors/savers who are likely to be much more sensitive to bank information (De Ceuster et al., 2003): Goldberg and Hudgins (1996, 2002) show evidence that uninsured deposits react more to signals of institutional failure and that there is a reduction in the ratio of uninsured deposits to total deposits in failing thrift institutions. However, evidence of market discipline exercised by insured depositors has also been found (Cook & Spellman, 1994; Davenport & McDill, 2006; Lamers, 2015; Martinez Peria & Schmukler, 2001; Park & Peristiani, 1998). This would be justified if the cost of the guarantee were high or there were concerns about the possibility that the insurance scheme would be fully recognized or about the credibility of its implementation.[7] In any case, the distinction between insured and uninsured deposits appears to be a relevant aspect when examining how deposit behavior can discipline bank risk-taking.

## 2.2 | Credit unions

Credit unions are financial cooperative associations which serve a limited group of members according to a defined "field of membership" which effectively restricts the customers to which the credit union can cater. The National Credit Union Administration (NCUA) defines three forms of membership: employment, association, or residence. CUs may be chartered by the federal government or by their state government. Federally chartered CUs may serve a single bond or field of membership or several groups (multiple field of membership) whereas for state-chartered CUs the possibility of serving more than one field of membership depends upon state regulations. CUs have a unique structure compared with banks, in that CU members play a dual role as both owners and depositors: owner shares are treated as deposits which receive an interest rate. CU members receive both shares and deposits protection by the NCUSIF, which provides deposit insurance to federally chartered credit unions and to most state chartered credit unions: some states allow CUs to be insured by private insurers instead of the NCUSIF. The limit of the deposit insurance was $100,000 per share owner but this limit increased to $250,000 in 2008.[8] By December 2018, there were 5,492 credit unions in the US, 3,376 of which were federally chartered and federally insured, 1,999 were state chartered and federally insured, and 117 were state chartered not federally insured.

[6] Interestingly, Martin et al. (2018) find that failing banks manage to attract insured deposits when banks are close to failure.

[7] Note, specifically, that a deposit insurance scheme could fail in a systemic crisis. For example, the assets held by the National Credit Union Share Insurance Fund (NCUSIF) are 16.7 billion dollars whereas total insured deposits are 1.22 trillion dollars: the ratio of total assets managed by NCUSIF to insured deposits is 1.37%. Thus, in bad economic times or in systemic crises the insurance fund is likely to be insufficient to cover all insured deposits. See: https://www.ncua.gov/Legal/Documents/Reports/annual-report-2019.pdf. In addition, given the fact that CUs coinsure one another through the structure of NCUSIF (Kane & Hendershott, 1996), potential financial contagion between CUs may trigger significant deposit reactions in the event of a large CU failure (Iyer & Peydro, 2011).

[8] "Congressional Law—H.R. 1424 (Section 136) increases the federal insurance on all eligible accounts temporarily through December 31, 2009. H.R. 1424 was signed into law October 3, 2008" (NCUA, 2008); The Dodd–Frank Wall Street Reform and Consumer Protection Act of 2010 made the new limit of $250,000 permanent (NCUA, 2010).

The literature on CUs has grown to be quite substantial and it has focused on the specific areas in which CUs differ from other depository institutions: the credit union maximization problem stemming from the dual role of owners/depositors (Leggett & Stewart, 1999; McKillop et al., 2020; Smith, 1984; Smith et al., 1981), interest rates and competition with the banking industry (Feinberg, 2001; Hannan, 2003; Tokle & Tokle, 2000), performance measures of CUs (Bauer, 2008; Bauer et al., 2009; Desrochers & Fischer, 2005; Fried et al., 1993, 1999; Goddard et al., 2008; Wilcox, 2005, 2006), growth (Goddard & Wilson, 2005; Goddard et al., 2002; Leggett & Strand, 2002), mergers and acquisitions (Bauer et al., 2009; Goddard et al., 2014; McAlevey et al., 2010), issues related to the field of membership (Black & Dugger, 1981; Ely, 2014; Frame et al., 2003; Goddard et al., 2002) and CU risk-taking strategies (Bauer et al., 2009; Ely, 2014; Emmons & Schmid, 1999; Fiordelisi & Mare, 2014; Frame et al., 2003; Van Rijn et al., 2019).

The behavior of deposits in CUs and the existence of depositor discipline, however, has received scarce attention. We reviewed in Section 1 the main reasons for this lack of attention: the peculiar characteristics of CU depositors (their dual role as owners, the field of membership definition, the closer relationship between members and the CU and the lower level of financial sophistication) make it less reasonable to expect that they exercise significant discipline over their CU. Some authors, however, have found some evidence of market discipline of CUs in international settings: Arnold et al. (2016) found mixed evidence of market discipline in commercial, savings banks and cooperative banks in Germany;[9] Murata and Hori (2006) found evidence of depositor discipline at Shinkin banks and credit cooperatives in Japan. For the US, evidence of depositor behavior in CUs is, in fact, quite limited. Kane and Hendershott (1996) argued that managerial incentives to benefit from risk-taking are limited by the intensity of monitoring by other CUs and private co-insurers. Karels and McClatchey (1999) evaluated whether the adoption of the deposit insurance scheme in Iowa increased risk-taking by CUs but found no significant evidence. Finally, Gómez-Biscarri et al. (2021) analyzed the effects of business lending on CU risk and found that CU deposits react negatively to risky business loans in an effect suggestive of discipline.

In this paper, we attempt to fill what we consider to be a relevant gap in both the depositor discipline and credit union literatures by offering what, to our knowledge, is the first comprehensive set of results on the existence of depositor discipline in CUs and of the mediating factors of such discipline.

## 3 | DATA

We collected quarterly data from the CU call reports available from the NCUA, which contain financial information for every CU that operates in the United States. Given that before 2003Q3 only CUs with assets higher than 50 million dollars (peer groups 4, 5 and 6) filed quarterly call reports we restrict our sample to those CUs with quarterly information.[10] Our sample period covers 1994Q1−2018Q4 (100 quarters), yielding an initial sample of 189,832 quarterly observations

[9] The findings in Arnold et al. (2016) suggest the existence of market discipline in cooperative banks prior to the crisis but not during the crisis. The opposite behavior was found for commercial banks.

[10] We run a robustness test and estimate the models in Table 2 for the universe of US CUs without the size restriction. In those analyses our sample period must be restricted to 2003Q3–2018Q4 to keep the quarterly frequency of the data. The results of those analyses, reported in Appendix C Table C2, are similar to the ones obtained on the main sample.

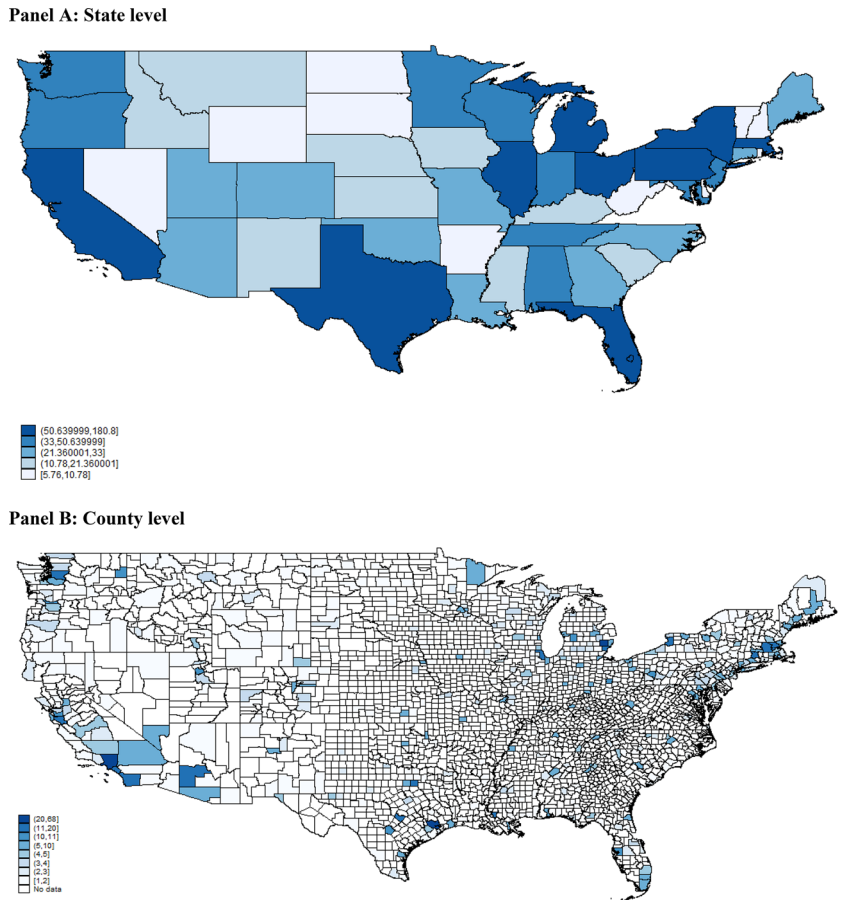


**FIGURE 1** Credit union distribution [Colour figure can be viewed at wileyonlinelibrary.com]

Notes: Distribution of CUs in our sample (CUs with assets larger than $50 million) at the state level (Panel A) and at the county level (Panel B) level. Dark blue represents higher concentration, light blue lower concentration, white means no CU

which correspond to a maximum of 2,353 CUs.[11] For descriptive purposes, we show in Figure 1 a map with the geographical distribution of the data at the state and county levels. Note that CUs are geographically concentrated, with especially high density in California, Texas and Michigan (and the counties of Los Angeles, California; Harris, Texas; and Wayne, Michigan) and very low density in states like Wyoming, Arkansas, Delaware and Vermont.[12] The graphs, along with the local character of CUs, suggest the importance to control for local economic factors, which we do in our analyses via inclusion of state × time fixed effects.[13]

The list of variables we collect is shown in Appendix A. Our main dependent variable of interest is the growth rate of total shares and deposits. As explanatory variables and controls we use

[11] Our panel is unbalanced given the length of the period and the natural process of creation, liquidation and M&As of CUs. Our sample starts with 971 CUs, reaches a maximum of 2,337 CUs in 2017Q2 and ends with 2,299 CUs in 2018Q4. On average we have 1,765 CU observations per quarter.

[12] The average number of CUs per county is 2 with a minimum of zero and a maximum of 68 in Los Angeles county.

[13] We opted for not including county or county×time fixed effects since around 45% of the counties in our sample only have one CU.

**TABLE 1** Descriptive statistics

| Variables | Mean | Median | StdDev | Min | Max |
|---|---|---|---|---|---|
| *Δshares* | 0.014 | 0.010 | 0.030 | −0.065 | 0.154 |
| *ΔS&D* | 0.014 | 0.011 | 0.030 | −0.065 | 0.154 |
| *Δunind* | 0.074 | 0.033 | 0.459 | −1.000 | 4.028 |
| *Δinsd* | 0.015 | 0.010 | 0.036 | −0.092 | 0.198 |
| *membersgrowth* | 0.005 | 0.005 | 0.026 | −0.109 | 0.190 |
| *ΔNonmembdep* | −0.011 | 0.000 | 1.335 | −0.611 | 20.698 |
| *Sav_rate* | 0.005 | 0.004 | 0.003 | 0.000 | 0.014 |
| *divregsh* | 0.011 | 0.005 | 0.012 | 0.000 | 0.053 |
| *intnonmemb* | 0.004 | 0.000 | 0.012 | 0.000 | 0.066 |
| *ROA* | 0.002 | 0.002 | 0.002 | −0.010 | 0.008 |
| *sdROA* | 1.217 | 0.845 | 0.999 | 0.000 | 11.231 |
| *PL* | 0.481 | 0.000 | 0.665 | 0.000 | 2.565 |
| *NWTA* | 0.109 | 0.103 | 0.030 | 0.050 | 0.241 |
| *NPL* | 0.010 | 0.007 | 0.009 | 0.000 | 0.061 |
| *Charge-offs* | 0.002 | 0.001 | 0.002 | 0.000 | 0.012 |
| *NIM* | 0.009 | 0.009 | 0.002 | 0.003 | 0.015 |
| *loansta* | 0.622 | 0.639 | 0.155 | 0.171 | 0.918 |
| *size* | 18.950 | 18.700 | 1.004 | 17.728 | 25.298 |
| *S&D* | 0.873 | 0.882 | 0.042 | 0.675 | 0.941 |
| *Nonmembdep* | 0.003 | 0.000 | 0.014 | 0.000 | 0.108 |
| *finlit* | 3.000 | 3.000 | 0.426 | 0.000 | 5.000 |
| *lowinc* | 0.138 | 0.000 | 0.345 | 0.000 | 1.000 |

*Note*: See Appendix A for variable definitions. Sample comprises credit unions with total assets higher than $50,000,000 observed through the period 1994Q1 to 2018Q4. CU-quarter observations in which a CU went through a merger are excluded. Continuous credit union variables were winsorized at the 0.5% level in each tail. Financial literacy (*finlit*) is observed every three years starting in 2009 and varies across 3-digit zip codes.

CU balance-sheet and income statement characteristics which describe the performance, asset strategies and risk taking of the CU. We review these variables as they appear in our analyses. All continuous CU variables are winsorized at the 0.5% level in each tail to avoid issues with outliers. We exclude from our sample the CU-quarter observations in which a merger or acquisition took place, which reduces our sample to 167,859 CU-quarter observations.[14] Tables 1 and C1 (in Appendix C) show some descriptive statistics and correlations of the main variables used in our analyses. Figure B1 and Table B1 in Appendix B shows the basic structure of the balance sheet and income statement that CUs report to the NCUA quarterly as well as the average balance-sheet (in total amounts and in % over total assets) and income statement (in total amounts and in % over total assets) of CUs at the beginning and at the end of our sample.[15] As it can be seen, the structure and activity of the typical CU has not changed much except for the fact that they have grown

[14] For robustness, we estimate our main models with a subsample that drops the observations of CUs involved in mergers or acquisitions subsequent to the period in which this transaction took place (see Section 6 and Appendix C, Table C3).

[15] The information provided by CUs in the call reports has changed over time: CUs currently report a larger number of variables. The main variables in our analyses -shares, deposits, number of members, nonmember deposits, assets, net


**FIGURE 2** Time series and cross-sectional variation of the main characteristics of CUs [Colour figure can be viewed at wileyonlinelibrary.com]

*Note*: Each panel of the figure shows a time series (yearly, 1994–2019) of boxplots of the main dependent and independent variables of our analyses

almost threefold in size (mostly through expansion of field-of-membership and M&As). Figure 2 shows the evolution of the main dependent and independent variables of our analyses: apart from interest rate variables (*Sav_rate*, *divregsh*, *intnonmemb* and, to a lesser extent, *NIM*) which evolve parallel to the interest rate levels in the economy, most of the variables—which are either growth rates or ratios adjusted for size—are relatively stable, which justifies our analysis based on a long sample. We do observe, however, significant variation along the cross-sectional dimension, which justifies the inclusion of CU controls and fixed effects in our analyses.

Additional information that we collected for specific analyses is:

- The credit union's field of membership and whether the CU has the low-income designation.

worth, net interest margin, delinquent loans, charge-offs, total loans, interest on deposits and loans- are available since 1994. The call report structure we show in Figure B1 of Appendix B corresponds to 2018Q4.

- The breakdown between uninsured and insured shares and deposits of the CU, to be used in the analysis of the effects of a deposit insurance scheme.
- A breakdown of deposits by term of maturity, which we use in some robustness analyses.
- Information at the 3-digit zip code level on financial literacy of the population. This variable, available from the state-level surveys of the National Financial Capability Studies conducted by FINRA Investor Education Formation (Lusardi & Mitchell, 2011) is used in the analyses of financial literacy.[16]

## 4 | A DESCRIPTIVE LOOK AT DISCIPLINE IN CREDIT UNIONS

In this section we start our analysis of depositor (member) discipline in CUs. We proceed in four steps: first, we look for general evidence of depositor discipline by looking at the reaction of CU shares and deposits, the number of CU members and interest rates to CU fundamentals and risk-taking indicators. We then move into analyses which are motivated by our discussion of the peculiar characteristics of CU members. In particular, we examine the effect of the deposit insurance scheme by distinguishing the behavior of insured and uninsured deposits. We then look at different horizons of depositor response, in order to examine the persistence or speed of discipline. Finally, we examine the effect of field of membership and other proxies for the intensity of the CU–member relationship on depositor discipline. We leave the analysis of the effect of financial literacy for Section 5.

### 4.1 | The relationship between CU deposits and fundamentals: Initial evidence of discipline

In order to give an initial description of CU depositor discipline, we use methodologies similar to those that have been applied to banks. Our first set of analyses consist of regressions of the main dependent variables of interest, growth in different measures of deposits, on a set of risk indicators and CU fundamentals, some of which have been previously used in the literature of market discipline of banks (Barajas & Steiner, 2000; Berger & Turk-Ariss, 2015; Calomiris & Powell, 2001; Martinez Peria & Schmukler, 2001) and some which are specific to credit unions (Bauer et al., 2009; Frame et al., 2003; Gómez-Biscarri et al., 2021). In particular, we use the following regressors: net worth over assets of the CU (*NWTA*), non-performing loans (*NPL*), loans over assets (*loansta*), return on assets (*ROA*) and the standard deviation of past ROAs (*sdROA*), the natural logarithm of 1 plus the number of past quarters with losses (*PL*) and the interaction of *PL* with *sdROA* (see Gómez-Biscarri et al., 2021).[17] We also include a measure of size (*size*, natural

[16] Data on the surveys on financial literacy is publicly available at the state level. We thank FINRA for providing us with data at the respondent level identified with the respondent's 3-digit zip code.

[17] The standard deviation of *ROA* has been used in the banking literature as an accounting-based measure of operational risk-taking (Agusman et al., 2008; Brewer & Lee, 1986; Hilari & Hue, 2009), even in analyses of depositor discipline (Goldberg & Hugins, 1996; Hannan & Hanweck, 1998). This measure, however, may not be linearly related to depositor reaction, since a high volatility caused by highly positive, but volatile ROAs, might not be disciplined. To control for that nonlinearity, we interact *sdROA* with past losses (*PL*). The coefficient on this interaction of *PL* with *sdROA* may be a better reflection of the disciplining of "bad volatility" or volatility in the presence of operational losses (see Gómez-Biscarri et al., 2021).

log of assets).[18] Finally, we control for the saving rate on shares and deposits (*Sav_rate*), computed as the (lagged) average interest rate paid by the CU on shares and deposits (Maechler & McDill, 2006). In all our tables we offer in Panel B an alternative specification, as a robustness test, where we replace non-performing loans (*NPL*) with charge-offs over loans (*Charge-offs*) and *ROA* with net interest margin (*NIM*). To ameliorate problems of endogeneity, in our regressions we use one-quarter lagged values of all CU risk indicators and fundamentals. In addition, to control for autocorrelation we use Driscoll-Kraay (DK, Driscoll & Kraay, 1998) standard errors with four lags, clustered by CU and time period.[19] Appendix A describes all our variables in more detail. Our baseline regression is as follows:

$$Y_{it} = \beta_1{}' RISK_{it-1} + \beta_2{}' Controls_{it-1} + u_i + s_j \times d_t + \varepsilon_{it}, \quad (1)$$

where $Y_{it}$ is one of four dependent variables (quarter-on-quarter growth in total shares and deposits, total shares, number of members and nonmember deposits), *RISK* is the vector of fundamentals and risk indicators (*ROA* or *NIM*, *sdROA*, past losses *PL*, the interaction $PL \times sdROA$, *NPL* or *Charge-offs* and total loans over assets) and *Controls* is the vector which contains *size* and *Sav_rate*. Finally, $u_i$ and $s_j \times d_t$ are are CU and state × time fixed effects included to control for CU unobserved heterogeneity and for local business cycle effects (at the state level).[20]

Results from estimation of model (1) are reported in Table 2 along with our predicted signs for the response coefficients. As expected, growth in shares and in total shares and deposits react positively to indicators of performance (*ROA*) and net worth (*NWTA*). The coefficient estimates imply that a one-standard deviation increase in *ROA* leads to an increase in *ΔS&D* of 0.14% (mean value is 1.4%: see Table 1) while a one-standard deviation increase in *NWTA*, leads to an increase in *S&D* of 0.45%. For the standard deviation of *ROA* (*sdROA*) and the measure of past-losses we do not obtain a significant result on the standalone coefficients, but the coefficient on the interaction of *sdROA* with past losses (*PL*) is negative and significant: we interpret this result as suggesting that depositors penalize the volatility which comes from bad performance, a result which makes intuitive sense.[21] Results on our main measure of asset risk (non-performing loans, *NPL*) are negative and statistically significant: a one standard deviation increase in *NPL* leads to a decrease in *ΔS&D* of 0.2%. These results are consistent with those previously obtained for banks, which suggests that CU members may respond similarly to most CU fundamentals. There are, however,

[18] Size has traditionally played an important role in analyses of depositor discipline. Iyer et al. (2019) show that systemically important banks successfully retain and attract uninsured deposits in a crisis at the expense of other banks even as they lower their interest rates. CUs are not systemically important banks but the largest CUs may have a different capacity to retain and attract deposits.

[19] There is some evidence of autocorrelation in the errors at lag four, generated by the seasonal lag. Apart from the use of DK autocorrelation-consistent standard errors, in untabulated results we have repeated our analyses including a 4-quarter lagged dependent variable (given the length of our panel, this inclusion should have a minor effect: Wooldridge, 2010): the results do not change at all by including this additional control. We thank an anonymous referee for her/his suggestion of explicitly controling for autocorrelation in our regressions.

[20] For robustness, we also run our regressions with CU fixed effects, time fixed effects and macroeconomic controls at the state level: inflation, personal income per capita and unemployment: see Section 6.

[21] *PL* is the log of one plus the number of quarters in which the CU reported losses during the previous three years. We also use two alternative measures of past losses in robustness analyses: an indicator (*pastlosses1*) that takes value 1 if the CU has reported at least one loss in the last 12 quarters, 0 otherwise, and (*pastlosses2*) that takes values equal to 1 when the CU has reported at least 2 losses during the last 12 quarters. In both cases, we obtain a negative and significant, at the 1% level, coefficient for the interaction between *pastlosses1* or *pastlosses2* with the standard deviation of ROA.

**TABLE 2** Depositor discipline: The response of shares and deposits and number of members to CU risk indicators

| **Panel A: Main specification** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **(1)** | | **(2)** | | **(3)** | | **(4)** | |
| **Dependent variable** | | ***Δshares*** | | ***ΔS&D*** | | ***membersgrowth*** | | ***ΔNonmembdep*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $ROA_{t-1}$ | + | 0.665*** | (9.34) | 0.693*** | (9.59) | 0.124** | (2.13) | 2.881 | (1.43) |
| $sdROA_{t-1}$ | − | 0.001 | (1.36) | 0.001 | (1.44) | 0.000 | (0.31) | −0.007 | (−0.59) |
| $PL_{t-1}$ | − | −0.000 | (−0.53) | −0.000 | (−0.37) | −0.000 | (−1.32) | −0.038 | (−1.37) |
| $PL_{t-1}\times sdROA_{t-1}$ | − | −0.001*** | (−4.71) | −0.001*** | (−4.85) | −0.001*** | (−8.76) | 0.012 | (1.13) |
| $NWTA_{t-1}$ | + | 0.140*** | (9.05) | 0.148*** | (9.47) | 0.023*** | (3.14) | 0.969* | (1.70) |
| $NPL_{t-1}$ | − | −0.201*** | (−9.73) | −0.215*** | (−10.43) | −0.099*** | (−8.07) | −2.130*** | (−3.53) |
| $loansta_{t-1}$ | − | 0.036*** | (14.95) | 0.038*** | (16.47) | 0.019*** | (16.26) | 0.422*** | (3.87) |
| $size_{t-1}$ | | −0.011*** | (−8.20) | −0.010*** | (−7.94) | 0.002*** | (3.34) | −0.143*** | (−2.89) |
| $Sav\_rate_{t-1}$ | + | 3.064*** | (11.78) | 2.931*** | (11.28) | 0.714*** | (5.07) | 0.000 | (1.33) |
| Observations | | 167,834 | | 167,834 | | 167,34 | | 3,543 | |
| *R*-squared | | 0.470 | | 0.464 | | 0.144 | | 0.438 | |
| **Panel B: Alternative specification** | | | | | | | | | |
| **Dependent variable** | | ***Δshares*** | | ***ΔS&D*** | | ***membersgrowth*** | | ***ΔNonmembdep*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $NIM_{-1}$ | + | 0.666*** | (4.28) | 0.680*** | (4.32) | 0.406*** | (3.32) | 8.608 | (0.55) |
| $Charge\text{-}offs_{t-1}$ | − | −1.301*** | (−10.13) | −1.383*** | (−10.84) | −0.880*** | (−11.58) | −13.179* | (−1.74) |
| Observations | | 167,834 | | 167,834 | | 167,340 | | 3,543 | |
| CU Controls | | YES | | YES | | YES | | YES | |
| *R*-squared | | 0.470 | | 0.464 | | 0.144 | | 0.436 | |
| CU FE | | YES | | YES | | YES | | YES | |
| State × time FE | | YES | | YES | | YES | | YES | |

*Notes*: Fixed-effects panel regressions of growth in shares (column 1), shares and deposits (column 2), number of members (column 3) and nonmember deposits (column 4) on CU characteristics. Column 4 restricts the sample to CUs with nonmember deposits higher than 5% of total shares and deposits in period $t-1$. Panel A: main specification. Panel B: Alternative specifications where *ROA* and *NPL* are replaced by *NIM* and *Charge-offs*. Both panels are estimated with CU and state × time fixed effects. See Appendix A for variable definitions. *t*-statistics are based on DK standard errors (with 4 lags) clustered by CU and quarter.

*, **, ***denote significance (based on two-tail tests) at 10%, 5% and 1% level.

some fundamentals for which the estimated coefficients imply differences in behavior between CU and bank depositors. First, the level of loans (proxied by loans over total assets, *loansta*) is positively related to shares and deposits growth.[22] Our expectation (and findings in the prior literature for banks: see Barajas & Steiner, 2000; Calomiris & Powell, 2001) was to find a negative coefficient. We believe this result is consistent with the peculiarities of CUs: since CU members benefit directly from loans granted by the CU, it may be expected that they do not punish the CU for the amount of loans granted. On the contrary, members might expect an active behavior in terms of granting loans while keeping a low risk of the loan portfolio. The positive estimated coefficient of *loansta* might, therefore, be a sign of borrower orientation preference by CU members.[23] The negative coefficient of *NPL* (and that of *Charge-offs* in panel B) shows that, although high levels of loans are viewed positively, members still expect that the CU has the ability to select and monitor the loans granted. It may be argued that a simultaneity between loans and deposits might also be behind this result: if a CU wants to increase its loans to a population (constrained by field of membership), it has to raise deposits in that population. In that sense, the positive sign could be a mechanic consequence of the borrower orientation preference of a CU. Untabulated results where we try to account for this simultaneity (by setting a simultaneous system of equations where deposit and loan growth are allowed to influence one another) still deliver a positive and significant coefficient of *loansta*, which we believe reinforces the idea that CU members view the loan granting activity of the CU positively.[24] The results on the two control variables suggest that higher saving rates lead to higher deposit growth—a result consistent with the banking literature—whereas size is negatively related to growth in shares and deposits. This latter result, which is in contrast with the findings for banks, can also be rationalized by the peculiarities of CUS: given the field of membership restrictions and some regulatory limits on CU activities, it is difficult for large CUs to grow in their traditional market, so further growth may be achieved by departing from the member-centric activities of the CU (Gómez-Biscarri et al., 2021). Finally, Panel B of Table 2 presents a subset of the estimated coefficients of the alternative specifications where *ROA* is replaced by *NIM* and *NPL* is replaced by *Charge-offs*. In both cases the results of Panel A carry through: the measure of performance (*NIM*) is positively correlated with subsequent deposit growth and the main proxy for asset risk (*Charge-offs*) is negatively correlated.

Though descriptive, we believe the results in columns 1–2 of Table 2 to be consistent with the depositor discipline view that CU deposits react positively (negatively) to signs of financial health (risk).[25] To gain further insights, we analyze in column 3 the behavior of CU membership by estimating model (1) using the quarter-on-quarter growth rate in the number of members (*membersgrowth*) as dependent variable. The results for membership reaction are qualitatively equal to those of deposits, although, as is reasonable, quantitatively lower. In other words, CU membership also reacts to CU fundamentals and asset risk in ways consistent with discipline. Finally,

[22] A one standard deviation increase in *loansta* leads to an increase in $\Delta S\&D$ of 0.59%.

[23] This terminology comes from Smith (1984) and Smith et al. (1981), who showed that CUs might have a depositor orientation, offering higher deposit rates, a borrower orientation, giving loans at lower rates or a neutral orientation (see, also, McKillop et al., 2020).

[24] We thank an anonymous referee for suggesting that we acknowledge and control for this potential simultaneity. The results of the systems of equations—where we use *Sav_rate* as the excluded instrument for $\Delta S\&D$ and a measure of average loan rates as the excluded instrument for loan growth—are available upon request.

[25] Note that in all our analysis of deposit growth, a decrease in growth rates may be interpreted as a withdrawal of deposits or as a lower increase in future deposits (i.e. a diversification of a member's deposits across depository institutions). Similarly, in the analysis of growth in the number of members, a decrease in growth rates may be interpreted as members leaving the CU or as a reduction in the inflow of new members.

we check whether the behavior of nonmember deposits is similar to that of member shares by estimating model (1) using growth in nonmember deposits (*ΔNonmembdep*) as dependent variable. Given that many CUs do not have nonmember deposits (80% of our sample) or have very small amounts, we restrict the sample for this regression (as we do for the statistics in Table 1) to CUs with nonmember deposits that represent at least 5% of total shares and deposits in period $t-1$.[26] The results, shown in column 4 of Table 2, are consistent with those of member deposits. The coefficient estimates and standard errors, however, are larger in magnitude. This is a consequence of the higher volatility of nonmember deposit growth (which, despite our sample restriction, is still 40 times higher than that of shares growth: see Table 1). Thus, some regressors which are significant for member deposits (most notably *ROA* and *NIM*) are not significant anymore. The main results, however, do carry through: the estimated coefficient of *NWTA* is positive and significant and the coefficients for the main asset risk indicators (*NPL* in panel A and *Charge-offs* in panel B) are negative and significant. The coefficients on *loansta* and *size* are also significant and of the same sign as those in columns 1–2. Hence, even though we take the results on nonmember deposits with a bit of caution, they suggest a behavior generally consistent with that of member deposits.

We now look at the relationship of interest rates paid on shares and deposits to CU fundamentals and risk-taking. The literature has interpreted this relationship from a disciplining perspective as suggesting that when a CU increases its risk taking, additionally to withdrawing their savings (Table 2) members may ask for higher interest rates (Arnold et al., 2016; Barajas & Steiner, 2000; Calomiris & Powell, 2001; Martinez Peria & Schmukler, 2001).[27] Alternatively, interest rates on deposits can be viewed as an active tool which the CU can use to try to prevent depositor outflow: this interpretation is, in any case, also reflective of discipline. This issue is particularly intriguing in the context of CUs: the discipline view (and our previous results) suggest that CUs with bad fundamentals may need to pay higher interest on deposits and dividends on shares to keep a certain level of deposits and shares in the CU. On the other hand, given the dual role of depositors as shareholders, the interest rates paid on member shares are indeed dividends, which tend to be linked to the good performance and high solvency of the CU. Thus, it is difficult to know a priori in what direction CU fundamentals will affect saving rates. We test the effect of fundamentals on saving rates using the following baseline regression:

$$Y_{it} = \beta_1{}' RISK_{it-1} + \beta_2{}' Controls_{it-1} + u_i + s_j \times d_t + \varepsilon_{it}, \quad (2)$$

where $Y_{it}$ is one of three measures of saving rates: first, *Sav_rate* measures the average rate that the CU pays on shares and deposits, (Dividends on shares + Interest on deposits)/Total shares and deposits (Bauer, 2008); second, we use the average dividend rate on regular shares (*divregsh*) which is reported in the call reports and is a pure dividend paid to the most common type of shares (which represent 35% of total shares as of December 2018);[28] third, we consider the nonmember deposit

[26] This restriction ameliorates to a large extent the extreme volatility in *ΔNonmembdep* for CUs with nonmember deposits close to zero. Non-tabulated results without the restriction are similar in terms of signs and statistical significance but with coefficients which are notably larger. We have also estimated regression models with alternative restrictions (5% of total assets, 1% of deposits, 1% of assets) and the results are comparable. These are available upon request.

[27] To our knowledge, this is the first paper to test the effect of fundamentals and risk taking on saving rates from a disciplining perspective in credit unions or cooperative banks.

[28] The other components of shares are: share certificates (22%), money market shares (20%), share drafts (16%), Ira/Keogh accounts (6%) and miscellaneous other shares (1%).

rate (*intnonmemb*), also from the call reports, which can be understood as a traditional interest rate on non-owner deposits. The variables in *RISK* are the same as in Equation (1) but *Controls* includes now *size* and an additional control for each of the three saving rate measures: we include the lagged value of total shares and deposits for *Sav_rate*, the lagged value of regular shares for *divregsh* and the lagged value of nonmember deposits for *intnonmemb*. As in Equation (1), we use CU and state × time fixed effects.

The results of model (2) are reported in Table 3. We comment first on the results for column 3 (*intnonmemb*), which are in line with our expectations: we find negative reaction coefficients for *ROA* and *NWTA*.[29] The coefficient for *NPL* has the expected sign (0.010) although is not statistically significant; in the alternative specification (Panel B), however, *Charge-offs* shows the expected positive and significant coefficient (at the 10% level). The reaction coefficient to the level of loans is positive and significant, suggesting that nonmember deposits rates increase when the CU expands the loan portfolio (which may be a consequence of the simultaneity effect we mentioned in the context of Table 2). The results on saving rates and dividends on regular shares are a bit more mixed. For *Sav_rates* (column 1) the coefficient of *NPL* is negative—a one standard deviation increase in *NPL* leads to a reduction of 0.27 basis points (bps) in *Sav_rate*—which goes against our expectations. The coefficients of *loansta*—positive: a one standard deviation increase in *loansta* leads to an increase of 0.31 bps in *Sav_rate*—and of *Charge-offs* (in the alternative specification) positive: a one standard deviation increase in *Charge-offs* leads to an increase of 0.42 bps in *Sav_rate*—do align with our expectations. Also, the results on *ROA* and *NWTA* (or *NIM* in Panel B) are consistent with depositor discipline. Regarding *divregsh* (column 3) we find no evidence that any credit risk indicator (*NPL* or *Charge-offs* or, even, *loansta*) is related to the dividend rates on regular shares. However, we find a positive coefficient for *ROA* and *NWTA* (not for *NIM*) which suggest that CUs with better performance/net worth pay higher dividend rates (a one standard deviation increase in *ROA* or *NWTA* lead to an increase of 1.82 bps and 4.8 bps on the dividend paid on regular shares). As in Table 2, the latter results, which are in contrast with previous findings for banks, can be rationalized by the dual role of CU members. The positive coefficient linking CU dividends with performance may not be a sign of lack of depositor discipline but of the capability of high-performing CUs to reward their owners.

## 4.2 | The impact of a deposit insurance scheme on discipline

We start now a set of analyses which look at the factors that affect the existence and extent of CU deposit reaction. We first examine the impact of a deposit insurance scheme, which splits deposits into those that fall under the insured limit and those uninsured. The first-order effect of insuring deposits is probably to mitigate or eliminate the reaction (discipline) of those deposits that are covered by the insurance system (Calomiris & Jaremski, 2019; Dam et al., 2015; Demirgüç-Kunt & Detragiache, 2002; Ioannidou & Penas, 2010; Iyer et al., 2016; Keeley, 1990; Martin et al., 2018). However, evidence of market discipline in insured deposits has been found in banks (Cook & Spellman, 1994; Davenport & McDill, 2006; Karels & McClatchey, 1999; Park & Peristiani, 1998). There are several arguments which suggest that insured deposits may still react—though probably less intensely than uninsured deposits—to CU fundamentals. First, insured deposits could move in response to changes in the probability of a systemic financial crisis, where the nationwide

[29] In the alternative specifications in Panel B *NIM* also has a negative and significant reaction coefficient.

**TABLE 3** Depositor discipline: The response of interest and dividend rates to CU risk indicators

| **Panel A: Main specification** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **(1)** | | **(2)** | | **(3)** | |
| **Dependent variable** | | ***Sav_rate*** | | ***divregsh*** | | ***intnonmemb*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $ROA_{t-1}$ | − | −0.008* | (−1.68) | 0.091*** | (4.72) | −0.048* | (−1.66) |
| $sdROA_{t-1}$ | + | −0.000 | (−0.72) | −0.000* | (−1.80) | −0.000** | (−2.48) |
| $PL_{t-1}$ | + | 0.000 | (0.07) | −0.000* | (−1.96) | −0.000 | (−0.63) |
| $PL_{t-1} \times sdROA_{t-1}$ | + | −0.000 | (−1.48) | 0.000 | (1.23) | 0.000* | (1.89) |
| $NWTA_{t-1}$ | − | −0.003** | (−2.56) | 0.016*** | (3.28) | −0.034*** | (−4.63) |
| $NPL_{t-1}$ | + | −0.003** | (−2.31) | −0.002 | (−0.52) | 0.010 | (1.02) |
| $loansta_{t-1}$ | + | 0.000* | (1.87) | −0.001 | (−1.51) | 0.004*** | (3.59) |
| $size_{t-1}$ | | 0.001*** | (9.63) | 0.001** | (1.99) | 0.001 | (1.38) |
| $S\&D_{t-1}$ | | 0.002*** | (5.44) | | | | |
| $Regshares_{t-1}$ | | | | −0.000 | (−1.48) | | |
| $Nonmembdep_{t-1}$ | | | | | | 0.303*** | (7.96) |
| Observations | | 167,834 | 167,751 | 167,751 | | | |
| *R*-squared | | 0.959 | 0.926 | 0.488 | | | |
| **Panel B: Alternative specification** | | | | | | | |
| **Dependent variable** | | ***Sav_rate*** | | ***divregsh*** | | ***intnonmemb*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $NIM_{t-1}$ | − | −0.272*** | (−16.11) | −0.447*** | (−7.28) | −0.178** | (−2.10) |
| $Charge\text{-}offs_{t-1}$ | + | 0.021*** | (3.11) | −0.012 | (−0.52) | 0.075* | (1.81) |
| Observations | | 167,834 | | 167,751 | | 167,751 | |
| CU controls | | YES | | YES | | YES | |
| *R*-squared | | 0.964 | | 0.927 | | 0.488 | |
| CU FE | | YES | | YES | | YES | |
| State × time FE | | YES | | YES | | YES | |

*Notes*: Fixed-effects panel regressions of interest and dividend rates on CU characteristics. Panel A: main specification. Panel B: Alternative specifications where *ROA* and *NPL* are replaced by *NIM* and *Charge-offs*. Column 1: average saving rates; column 2: average dividend on regular shares; column 3: interest on nonmember deposits. Both panels are estimated with CU and state × time fixed effects. See Appendix A for variable definitions. *t*-statistics are based on DK standard errors (with 4 lags) clustered by CU and quarter.

*, **, *** denote significance (based on two-tail tests) at 10%, 5% and 1% level.

depositor insurance fund could be insufficient to honor all guarantees (see footnote 7). Additionally, insured depositors may decide to diversify their subsequent savings across institutions when their "traditional" depository institution shows signs of worsening fundamentals. A third set of arguments rests on the particularities of CUs explained in the introduction, especially the coinsurance feature (cross-CU deposits may be more responsive than member deposits). Finally, insured deposits have been shown to act as followers of the more sophisticated (typically uninsured) deposits (Davenport & McDill, 2006; Park & Peristiani, 1998). Uninsured depositors, on the other hand, are unconditionally expected to be much more reactive, given their higher exposure to bankruptcy of a specific institution and the fact that they tend to be more sophisticated or, at least, have higher incentives to be informed about CU fundamentals.

We use data on the split between insured and uninsured CU deposits and in Table 4 we show the results of estimating model (1) with growth in insured ($\Delta insd$) and uninsured ($\Delta unind$) deposits as dependent variables. For insured deposits (column 1), the results are parallel, in signs and significance, to those of total shares and deposits in Table 2, although the reaction coefficients are of slightly smaller magnitude, suggesting that insured deposits are less reactive overall: note that insured deposits react positively to *ROA*, *NWTA* and negatively to bad volatility ($PL \times sdROA$), and *NPL*.[30] For uninsured deposits (column 2), the results are more noteworthy. Note that the reaction coefficients which are statistically significant are always noticeably larger than those of insured deposits (and of total shares and deposits in Table 2). For example, uninsured deposits react to the the risk measures (*NPL* and *Charge-offs*) with reaction coefficients which are four times larger than those of insured deposits. Also, the positive reaction to *NWTA*, *Sav_rates* and *loansta* are three, two and four times larger, respectively, than those of insured deposits and shares. We believe that these results provide strong evidence that: (a) there is (weak) depositor discipline on insured deposits/shares of CUs; (b) depositor discipline is considerably higher for uninsured deposits, especially when indicators of credit risk deteriorate.

## 4.3 | The persistence of discipline

Our baseline analyses focus on immediate deposit reaction by using quarter-on-quarter growth of deposits regressed on one-quarter lagged regressors. We now attempt to give some evidence of the speed and persistence of the reaction of deposits to CU fundamentals. For that purpose, we repeat our baseline regressions using as dependent variable the growth of deposits and shares accumulated over several quarters (1 to 8).[31] We report the results of this analysis graphically in Figure 3.[32] Each of the six graphs in the figure plots the estimated response coefficients of shares and deposits growth to one of our regressors (*NPL*, *Charge-offs*, *NWTA*, *ROA, PL* × *sdROA* and *NIM*) for the eight different (cumulative) horizons. The graphs show strong evidence that depositor discipline takes several quarters to fully realize. Note that the effects accumulate over time, but at smaller rates. In other words, the reaction is long-lasting, but it tends to die out (quite slowly) over time: note that for *NPL*, *NWTA* and *ROA* the reaction is still increasing (in magnitude) after eight quarters. For *Charge-offs*, bad volatility ($PL \times sdROA$) and *NIM* the reaction seems to last three or four quar-

[30] The results in Panel B are also consistent with those of Panel B of Table 2.

[31] Regressions for quarter $t + 1$ are done using CU and state×time fixed effects and DK standard errors with four lags clustered by CU and quarter. For quarters $t + 2$ to $t + 8$, given the problem of overlapping errors which this definition generates, we use DK standard errors with the lag augmented by the cumulative horizon.

[32] Tables with regression estimates are available upon request.

**TABLE 4** The response of insured and uninsured deposits to risk indicators

| **Panel A: Main specification** | | | | | |
|---|---|---|---|---|---|
| | | **(1)** | | **(2)** | |
| **Dependent variable** | | ***Δinsd*** | | ***Δunind*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $ROA_{t-1}$ | + | 0.664*** | (11.69) | 0.562 | (0.65) |
| $sdROA_{t-1}$ | − | 0.000 | (1.22) | 0.004 | (1.30) |
| $PL_{t-1}$ | − | 0.000 | (0.37) | −0.003 | (−0.79) |
| $PL_{t-1} \times sdROA_{t-1}$ | − | −0.001*** | (−4.28) | −0.001 | (−0.74) |
| $NWTA_{t-1}$ | + | 0.132*** | (9.36) | 0.422*** | (3.55) |
| $NPL_{t-1}$ | − | −0.190*** | (−9.91) | −0.797** | (−3.36) |
| $loansta_{t-1}$ | − | 0.036*** | (15.75) | 0.142*** | (8.09) |
| $size_{t-1}$ | | −0.009*** | (−7.96) | −0.062*** | (−6.86) |
| $Sav\_rate_{t-1}$ | + | 2.823*** | (11.21) | 5.621** | (2.49) |
| Observations | | 164,989 | | 142,331 | |
| *R*-squared | | 0.426 | | 0.115 | |
| **Panel B: Alternative specification** | | | | | |
| **Dependent variable** | | ***Δinsd*** | | ***Δunind*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $NIM_{t-1}$ | + | 0.569*** | (3.62) | 2.203 | (1.53) |
| $Charge\text{-}offs_{t-1}$ | − | −1.241*** | (−10.71) | −5.726*** | (−5.32) |
| Observations | | 164,989 | | 142,331 | |
| CU controls | | YES | | YES | |
| *R*-squared | | 0.321 | | 0.039 | |
| CU FE | | YES | | YES | |
| State × time FE | | YES | | YES | |

*Notes*: Fixed-effects panel regressions of insured shares growth (column 1) and uninsured shares growth (column 2) on CU characteristics. Panel A: main specification. Panel B: Alternative specifications where *ROA* and *NPL* are replaced by *NIM* and *Charge-offs*. Both panels are estimated with CU and state × time fixed effects. See Appendix A for variable definitions. *t*-statistics are based on DK standard errors (with 4 lags) clustered by CU and quarter.

*, **, *** denote significance (based on two-tail tests) at 10%, 5% and 1% level.

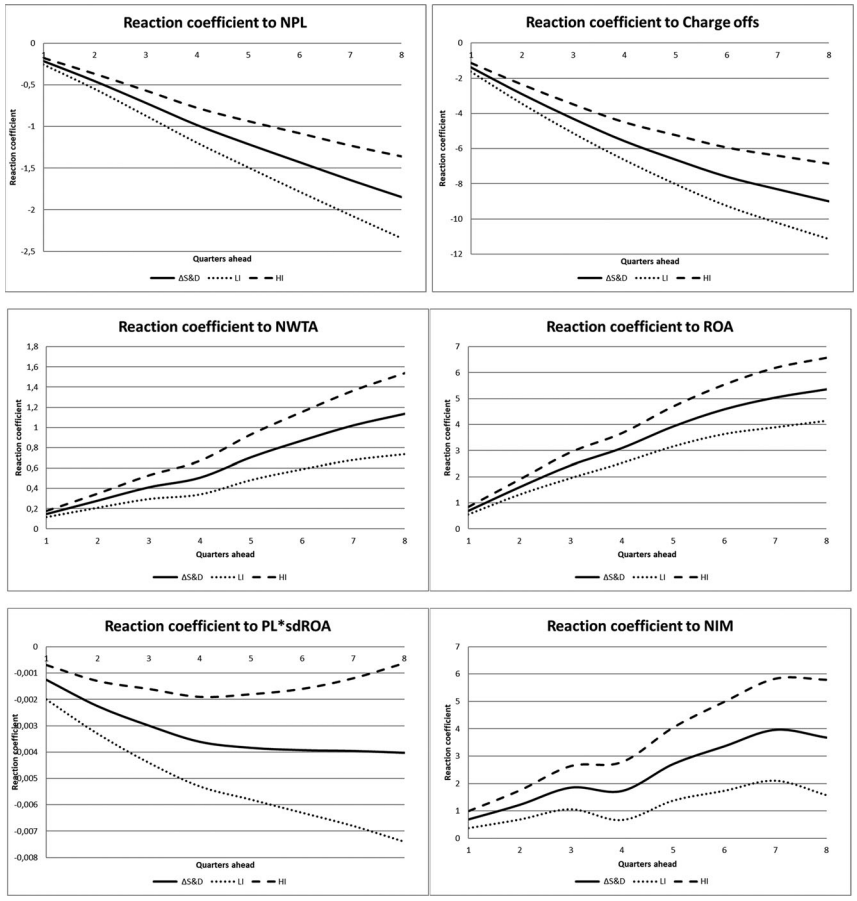


**FIGURE 3** Discipline takes time: reaction coefficients of deposit growth at different horizons

Notes: The six panels show the estimated reaction coefficients of regressions of 1 to 8 quarters ahead growth in total shares and deposits (solid thick line) to the variables *NPL*, *Charge-offs*, *NWTA*, *ROA*, bad volatility (*PL* × *sdROA*) and *NIM*. The regressions include CU and state × time fixed effects.The 95% confidence interval is also shown (lower interval with dotted line and upper interval with dashed line). Standard errors are DK, robust to clustering by CU and time period and to autocorrelation, computed with a lag equal to four (baseline lag of analysis in the paper) plus the horizon of cumulative growth

ters, leveling off afterwards. Though relatively simple, this persistence analysis confirms that the reaction of CU shares and deposits is relatively slow. The reasons for this may be fourfold: first, the slow reaction may be suggestive of a more patient attitude of CU members, rooted in the high commitment to the CU. Also, the close links between CUs and members and the services that the CUs provide to members may play a role. CU members who benefit from loans or credit lines may be reluctant to abandon the CU in times of difficulties and decide instead to reduce their exposure without eliminating completely their CU (see Table 2 column 3). Second, it may be the case that CU members do not discipline the CU by aggressively withdrawing deposits but, rather, by diversifying their subsequent deposits. Third, depositors, probably more in the case of CUs, take time to learn and process the information about their depository institution risk-taking. This may be a consequence of their lower financial sophistication (more on this in Section 5) and of the fact that they learn of this information through alternative, more informal channels (nonfinancial news, person-to-person communication in the community,…). Thus, reaction to the CU's financial sit-

uation may be relatively slow (and, statistically, more persistent). Fourth, it may be the case that the slow movement is related to the maturity of deposits: open accounts may react to the first signals of deterioration whereas members with accounts with large maturities may take longer to react.[33]

## 4.4 | Depositor reaction and the relationship of members with the CU

Our discussion suggests that informational and relational mechanisms should be important mediators of depositor discipline.[34] In this section we provide two analyses which examine how depositor discipline in CUs is related to two groups of variables which can be seen as proxies for the strength of such mechanisms within the CU:

- Community field of membership: according to the NCUA, a community CU operates in a "geographically well-defined local community or neighborhood" or in a rural district.[35] Community CUs are, by their very nature, geographically concentrated. This physical proximity creates informal links between community residents and managers (who are probably also residents) which reduce the asymmetry of information. Also, these CUs are in the US more subject to the competition of commercial banks, which have a similar local focus. These two characters suggest that we may find more evidence of discipline in community CUs.
- Single common bond—associational: these are CUs whose members "participate in activities developing common loyalties, mutual benefits, and mutual interests" (NCUA, 2003). This includes, for example, members of a church or of a trade union. For these CUs we expect that, although the asymmetry of information might be low, the higher loyalty of members towards the CU (a stronger bank–client relationship) will dominate and reduce the extent of discipline (Brown et al., 2020).
- Single common bond—occupational: these are defined as CUs "that serve a single occupational sponsor" such as a corporation, trade industry or profession.[36] Similarly to associational common bond CUs, we expect that the closer relationship of members with colleagues or with the sponsor (when the CU is sponsored by a common employer) will reduce the extent of discipline.
- Multiple field of membership: credit unions may apply for a multiple field of membership (MFOM). For this type of CUs we do not expect the loyalty to the sponsor or association to play a significant role. On the other hand, however, we expect the asymmetry of information, particularly when compared with a community or associational CU, to be higher. Thus, we have no strong priors regarding the relative strength of discipline in MFOM CUs.

[33] We repeated the analysis in Figure 3 for groups of deposits of different maturities. The results tentatively suggest that indeed longer-term deposits take longer to react but their cumulative reaction is larger in magnitude and more long-lasting. We take this evidence with some caution: since we cannot observe flows of deposits among the different maturities, these results could be a consequence of maturity shifting of deposits—with members favoring short-term or open accounts—rather than discipline strictly speaking. We offer these results upon request but also suggest that future research brings the term of maturity into the analysis of discipline in a more explicit manner.

[34] According to Brown et al. (2020) the intensity of the bank–client relationship mitigates depositor discipline on distressed banks, particularly in no-crisis times.

[35] See 12 CFR Part 701—NCUA.

[36] https://www.law.cornell.edu/cfr/text/12/appendix-B_to_part_701.

We examine how field of membership affects the discipline effect by re-estimating equation (1) for subsamples determined by field of membership: community CUs (Table 5, column 1), CUs with multiple fields of membership (column 2), and CUs with association common bond and occupational field of membership (column 3).[37,38] The results are indeed suggestive of some differences in deposit reaction across fields of membership. The most noticeable difference is that for both community and MFOM CUs the reaction coefficients to risk measures (*NPL* and *Charge-offs*) are statistically significant and of similar or slightly higher magnitude than the baseline results of Table 2. In contrast, we find no significant reaction of depositors of associational and occupational CUs to the main measures of risk. These differences are unlikely to be a consequence of the smaller sample size of the group of associational CUs, since the coefficients of the other non-risk fundamentals are quite similar and statistically significant across all three groups (suggesting that members of occupational or associational CUs do react to indicators of financial health and loan activity, so they are not fully unresponsive).[39] All in all, the results in Table 5 are consistent with our expectation that members of associational/occupational CUs are less reactive, a behavior which may be a consequence of the stronger commitment to the sponsor or association (a more intense CU–member relationship).

We perform a set of additional analyses using three variables which the literature has suggested as proxies for the strength of the relationship between the client and the depository institution. First, we use the proportion of nonmember deposits over total shares and deposits. The CU literature has suggested that members have a more long-term relationship with the CU, enhanced by the fact that membership tends to incorporate the entire family (Tuominen et al., 2006).[40] Hence, we expect that CUs with lower proportion of nonmember deposits (or without nonmembers) will have a more intense CU–member relationship than those with high proportions of nonmember deposits. Second, we use CU size as an (inverse) proxy of CU–member relationship: we expect smaller CUs to have a stronger CU–member relationship. According to Byrne et al. (2012), CU members prefer local and smaller CUs rather than larger centralized CUs and place a higher value on their relationship with the small CUs. Finally, we take a third proxy from the relationship banking literature (Degryse & Ongena, 2008, and López-Espinosa et al., 2017) and use the share of interest income to total income as a measure of a CU's borrower orientation, which the literature shows to be correlated with the strength of the client–bank relationship. We expect that CUs with higher borrower orientation may have a closer CU–member relationship.

We show in Table 6 the results of estimating model (1) splitting the sample into two groups determined by each of the three proxies. Columns 1–2 contain the results of splitting the sample into CUs with zero or very low nonmember deposits (CUs with a share of nonmember deposits below the 90% percentile, column 1) and those with higher proportions of nonmember deposits (above

[37] Note that we pool CUs with associational and occupational common bond. We do this for two reasons: first, our expectations regarding these two groups are similar, since the loyalty to the sponsor or peers should reduce the intensity of discipline; second, both groups are smaller in size (note that column 3 has only 6,375 observations while columns 1 and 2 have 32,810 and 47,694 observations, respectively).

[38] We run the regressions in Table 6 only for federal chartered CUs, since there is no information about the field of membership of state chartered CUs from 2002Q2 onwards.

[39] For robustness, we separate the samples of occupational and associational field of membership CUs and we do not find a significant coefficient for *NPL* or *Charge-offs*. We also estimated Table 5 restricting the sample to CUs which do not change field-of-membership throughout our sample period (see Section 6) and the main conclusions remain unchanged.

[40] Also, according to Byrne and McCarthy (2014) cooperative members show a higher preference for the relational value proposition of CUs rather than for technical value propositions.

**TABLE 5** The impact of field of membership on the disciplining effect

| **Panel A: Main specification** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | **(1)** | | **(2)** | | **(3)** | |
| | | **Community** | | **Multiple field of membership** | | **Associational and Occupational** | |
| **Dependent variable** | | ***ΔS&D*** | | ***ΔS&D*** | | ***ΔS&D*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $ROA_{t-1}$ | + | 0.473*** | (3.86) | 0.868*** | (8.87) | 1.201*** | (3.48) |
| $sdROA_{t-1}$ | − | -0.000 | (−0.73) | -0.000 | (−0.15) | 0.001 | (0.40) |
| $PL_{t-1}$ | − | -0.000 | (−0.25) | 0.000 | (0.11) | -0.002 | (−1.05) |
| $PL_{t-1} \times sdROA_{t-1}$ | − | -0.001 | (−1.63) | -0.001 | (−1.52) | 0.000 | (0.07) |
| $NWTA_{t-1}$ | + | 0.197*** | (7.05) | 0.199*** | (8.84) | 0.203*** | (3.68) |
| $NPL_{t-1}$ | − | -0.237*** | (−6.45) | -0.250*** | (−6.69) | 0.072 | (0.88) |
| $loansta_{t-1}$ | − | 0.036*** | (10.81) | 0.043*** | (11.55) | 0.054*** | (5.27) |
| $size_{t-1}$ | | -0.015*** | (−7.45) | -0.013*** | (−6.27) | -0.010*** | (−2.65) |
| $Sav\_rate_{t-1}$ | + | 3.711*** | (9.25) | 3.773*** | (10.70) | 4.023*** | (3.92) |
| Observations | | 32,810 | | 47,694 | | 6,375 | |
| *R*-squared | | 0.539 | | 0.512 | | 0.541 | |
| **Panel B: Alternative specification** | | | | | | | |
| | | **Community** | | **Multiple field of membership** | | **Associational and Occupational** | |
| **Dependent variable** | | ***ΔS&D*** | | ***ΔS&D*** | | ***ΔS&D*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $NIM_{t-1}$ | + | 0.279 | (0.77) | 0.844*** | (3.36) | 1.526* | (1.90) |
| $Charge\text{-}offs_{t-1}$ | − | −1.496*** | (−8.56) | −1.214*** | (−5.69) | −0.156 | (−0.49) |
| Observations | | 32,810 | | 47,694 | | 6,375 | |
| CU Controls | | YES | | YES | | YES | |
| *R*-squared | | 0.539 | | 0.510 | | 0.540 | |
| CU FE | | YES | | YES | | YES | |
| State × time FE | | YES | | YES | | YES | |

*Notes*: Fixed-effects panel regressions of shares and deposits growth on CU characteristics as a function of the field of membership. In all cases the sample is restricted to Federal chartered CUs. Panel A: main specification. Panel B: Alternative specifications where *ROA* and *NPL* are replaced by *NIM* and *Charge-offs*. Column 1: sample is restricted to community CUs; column 2: sample is restricted to multiple field of membership CUs; column 3: sample is restricted to associational and occupational CUs. Both panels are estimated with CU and state × time fixed effects. See Appendix A for variable definitions. *t*-statistics are based on DK standard errors (with 4 lags) clustered by CU and quarter.

*, **, *** denote significance (based on two-tail tests) at 10%, 5% and 1% level.

**TABLE 6** Depositor reaction and the relationship of members with the CU

| **Panel A: Main specification** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **(1)** | | **(2)** | | **(3)** | | **(4)** | | **(5)** | | **(6)** | |
| **Proxy** | | **Nonmember deposits** | | | | **Size** | | | | **Borrower orientation** | | | |
| **Subsample** | | **Low** | | **High** | | **Low** | | **High** | | **High** | | **Low** | |
| **Dependent variable** | | ***ΔS&D*** | | | | | | | | | | | |
| **Variables** | **Pred** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** |
| $ROA_{t-1}$ | + | 0.655*** | (8.51) | 0.691*** | (3.65) | 0.249* | (1.68) | 0.971*** | (5.45) | 0.460* | (1.81) | 0.522*** | (4.19) |
| $sdROA_{t-1}$ | − | 0.000 | (1.34) | 0.001 | (1.45) | −0.001 | (−0.79) | 0.000 | (0.10) | 0.001* | (1.75) | 0.000 | (0.16) |
| $PL_{t-1}$ | − | −0.000 | (−0.42) | −0.001 | (−0.66) | 0.000 | (0.40) | 0.000 | (0.10) | 0.000 | (0.24) | −0.000 | (−0.17) |
| $PL_{t-1} \times sdROA_{t-1}$ | − | −0.001*** | (−4.88) | −0.002*** | (−3.22) | −0.000 | (−0.12) | −0.001 | (−1.33) | −0.001*** | (−2.85) | −0.001** | (−2.23) |
| $NWTA_{t-1}$ | + | 0.153*** | (9.83) | 0.326*** | (6.86) | 0.631*** | (9.06) | 0.150*** | (4.04) | 0.196*** | (6.48) | 0.295*** | (7.82) |
| $NPL_{t-1}$ | − | −0.195*** | (−8.34) | −0.294*** | (−5.41) | −0.091* | (−1.92) | −0.366*** | (−5.10) | −0.140*** | (−4.37) | −0.217*** | (−4.36) |
| $loansta_{t-1}$ | − | 0.035*** | (13.09) | 0.084*** | (11.21) | 0.076*** | (11.73) | 0.035*** | (6.15) | 0.033*** | (7.15) | 0.044*** | (6.96) |
| $size_{t-1}$ | | −0.012*** | (−10.22) | −0.015*** | (−4.50) | | | | | −0.016*** | (−6.27) | −0.008*** | (−2.86) |
| $Sav\_rate_{t-1}$ | + | 3.103*** | (11.87) | 1.190 | (1.50) | 3.064*** | (5.45) | 1.191** | (2.60) | 4.109*** | (6.57) | 3.194*** | (5.41) |
| Observations | | 138,639 | | 15,393 | | 15,331 | | 15,904 | | 13,433 | | 13,162 | |
| R-squared | | 0.483 | | 0.531 | | 0.612 | | 0.567 | | 0.487 | | 0.648 | |

(Continues)

**TABLE 6** (Continued)

| **Panel B: Alternative specification** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Dependent variable** | ***ΔS&D*** | | | | | | | | | | | |
| **Variables** | **Pred** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** | **Coeff** | ***t*-stat** |
| $NIM_{-1}$ | + | 0.648*** | (3.87) | 0.349 | (0.91) | 0.402 | (1.05) | 1.455*** | (5.07) | | | | |
| $Charge\text{-}offs_{t-1}$ | − | −1.226*** | (−8.94) | −1.576*** | (−5.65) | −0.497** | (−2.18) | −2.279*** | (−5.78) | −0.516** | (−2.24) | −1.334*** | (−6.06) |
| Observations | | 138,639 | | 15,393 | | 15,331 | | 15,904 | | 13,433 | | 13,162 | |
| CU Controls | | YES | | YES | | YES | | YES | | YES | | YES | |
| R-squared | | 0.482 | | 0.530 | | 0.613 | | 0.566 | | 0.485 | | 0.648 | |
| CU FE | | YES | | YES | | YES | | YES | | YES | | YES | |
| State × time FE | | YES | | YES | | YES | | YES | | YES | | YES | |

*Notes*: Fixed-effects panel regressions of growth in shares and deposits on CU characteristics. Column 1 (2) restricts the sample to CUs with nonmember/total shares and deposits below (above) the 90% percentile. Column 3 (4) restricts the sample to CUs in the lowest (highest) size decile. Column 5 (6) restricts the sample to CUs with interest income/total income in the highest (lowest) decile. Panel A: main specification. Panel B: Alternative specifications where *ROA* and *NPL* are replaced by *NIM* and *Charge-offs*. *size* is omitted from the models in columns 3–4 and *NIM* is omitted from the models in columns 5–6. Both panels are estimated with CU and state × time fixed effects. See Appendix A for variable definitions. *t*-statistics are based on DK standard errors (with 4 lags) clustered by CU and quarter.

*, **, *** denote significance (based on two-tail tests) at 10%, 5% and 1% level.

the 90% percentile, column 2).[41] The results suggest a stronger reaction of shares and deposits to the risk indicators for the CUs with higher proportion of nonmember deposits (column 2 vs column 1). Note that the estimated coefficients of *PL* × *sdROA*, *NWTA*, *NPL*, *ROA* and *Charge-offs* are much larger in column 2 than in column 1 (in the case of the first three indicators, more than twofold). Columns 3 and 4 contain the results for the split on the basis of size: we take CUs in the lowest size decile (column 3) and compare them to CUs in the highest size decile (column 4).[42] Again, the results align with our expectations and for most risk indicator (with the exception of *NWTA*) the estimated coefficients are notably larger (in absolute value and with the expected sign) for the largest CUs in column 4. Finally, columns 5 and 6 show the results obtained for the split on the basis of the share of interest income (we again focus on the extreme deciles, noting that "High" borrower orientation corresponds to CUs with a high share of interest to total income). The results for this specification are, again, aligned with our expectations: CUs with lower borrower orientation (and, thus, a weaker CU–member relationship: column 6) show a stronger reaction to all the risk indicators, with the exception of $PL_{t-1} \times sdROA_t$, than CUs with a high borrower orientation (column 5). In sum, the results in Table 6 also suggest that the intensity of the relationship (and informational asymmetries) between a CU and its members is related to how willing the members are to discipline the CU. Alternatively, CUs with a stronger bond with their members appear to be subject to lower depositor discipline and, therefore, face more stable financing.

## 5 | THE EFFECT OF THE CAPACITY OF CU MEMBERS TO PROCESS FINANCIAL INFORMATION

In this section, we evaluate whether the capacity of CU members to understand and process financial information may influence the extent of depositor discipline. This issue, we believe, deserves standalone attention: the existence of depositor discipline rests very directly on the ability of depositors to learn and process the financial information of the CU. There is extensive literature on how financial literacy affects the ability of people to make financial decisions (Campbell, 2006; Dhar & Zhu, 2006; Klapper et al., 2013; Lusardi & Mitchell, 2011; Van Rooij et al., 2011) and, as one particular example, to exercise depositor discipline: Widdowson and Hailwood (2007) suggest that people with higher financial knowledge exercise higher depositor discipline; also, Davenport and McDill (2006) find that the more sophisticated depositors (proxied by those with uninsured deposits) react more intensely and faster to signals of bank failure. Our results from Table 4 were already in line with the argument that financial sophistication leads to higher depositor reaction. However, the context of CUs warrants further analysis, given that, traditionally, CU members tend to be relatively small, unsophisticated investors, who are not expected to be reactive to CU financial information. We incorporate the dimension of financial sophistication of CU members in our baseline regressions by using three different proxies:

1. Financial literacy: we use the state-level surveys of the National Financial Capability Studies of 2009, 2012, 2015 and 2018 (conducted by FINRA) to construct the proxy *finlit*, which is the

[41] The reason for the 90%/10% split is that more than 80% of CUs do not have nonmember deposits: in our sample, mean nonmember deposits/total shares and deposits is 0.42% and the median and 75% percentile are 0.

[42] For columns 3–4 and 5–6, splits based on the extreme quartiles rather than deciles lead to the same results. These are available upon request. Note that in the size and interest income models of columns 3–4 and 5–6 we omit the size and *NIM* variables, that are already controlled for by the split.

average number of correct answers to the standardized finance quiz in the surveys. We obtained the data on the individual responses identified by the 3-digit zip code of the respondent.[43] We restrict our analysis to community CUs that operate in a specific "geographically well-defined local community or neighborhood", which allows us to match the 3-digit zip code measure of financial literacy to the zip code where the CU operates. We restrict our regressions to the period covered by the surveys (2009–18). Given that the surveys are conducted every three years, for the two years in-between surveys we interpolate linearly the values of *finlit* of the previous and subsequent survey.

2. Low-Income designation (LID) of the CU: NCUA regulation states that "a credit union serving predominantly low-income members may be designated as a low-income credit union."[44] Given that members of low-income CUs have lower wages or income, it is presumable that they will have lower levels of financial awareness and sophistication. Indeed, Dhar and Zhu (2006) find a relation between income level and financial decisions; specifically, they show that high-income individuals display a lower disposition effect. This result, along with the evidence in Davenport and McDill (2006), suggests that income might be used as a proxy for financial literacy. Therefore, we expect that CUs which have the LID will receive less discipline when compared to CUs without the LID. We define a variable *LID* as a dummy which takes value 1 when the CU is under the LID.
3. Personal income per capita: we use the evidence in the literature on the link between wages/income and financial sophistication and collect data on personal income per capita at the county level.

We use each of the three proxies described above to split our sample into two subsamples which differ on the level of financial literacy. In the case of *finlit* and county income per capita we use observations in the lower and upper quartile of the distribution of each variable.[45] In the case of *LID* our subsamples are the CUs with and without the LID. We then estimate the baseline model (1) for the two subsamples.

Table 7 reports the results of the analysis based on *finlit*, where the sample is restricted to community CUs (for which we can match the 3-digit zip code measure of *finlit* to the CU's member base). The reaction coefficients for *NWTA*, *NPL* and *NIM* (Panel B) do align with our expectation that CUs where members have higher levels of financial literacy exercise stronger discipline: the reaction coefficients are, respectively, 1.5, 1.4 and 6.5 times higher for the upper quartile CUs than for the lower quartile (for which the coefficients on *NPL* and *NIM* are not significant at the 5% level). Interestingly, the coefficients associated to *ROA*, loans and saving rates are also larger for CUs in the lower quartile: these results are consistent with the view that less sophisticated depositors react more to simple measures of profitability (*ROA*), borrower orientation (loans) or saver orientation (interest on deposits) of the CU.

We show in Table 8 the results for the other two proxies based on income. Columns 1–2 contain the results from the split on the basis of the LID, for which we can keep all observations (given that we have a clean identification for all CUs and time periods of whether they have the LID or not). The results are more consistent than those in Table 7 with our expectations: members of CUs without the LID react more intensely to *ROA* (coefficient is 1.4 times higher), bad volatility

[43] We thank an anonymous referee for the suggestion to use zip code data instead of the publicly available data at the state level. We also thank FINRA for providing us with the respondent level data and zip code information.

[44] Section 701.34 of NCUA's Rules and Regulations.

[45] We calculate the quartiles quarter-by-quarter.

**TABLE 7** The effect of measures of capacity to process information—Financial literacy

| **Panel A: Main specification** | | | | | |
|---|---|---|---|---|---|
| | | **(1)** | | **(2)** | |
| **Subsample:** | | **First quartile—*finlit*** | | **Fourth quartile—*finlit*** | |
| **Dependent variable** | | ***ΔS&D*** | | ***ΔS&D*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $ROA_{t-1}$ | + | 0.626** | (2.37) | 0.114 | (0.40) |
| $sdROA_{t-1}$ | − | −0.001 | (−0.62) | 0.000 | (0.24) |
| $PL_{t-1}$ | − | −0.003** | (−2.43) | 0.002 | (1.32) |
| $PL_{t-1} \times sdROA_{t-1}$ | − | 0.001 | (1.54) | −0.001 | (−0.94) |
| $NWTA_{t-1}$ | + | 0.403*** | (5.85) | 0.601*** | (6.38) |
| $NPL_{t-1}$ | − | −0.156* | (−1.89) | −0.215*** | (−3.15) |
| $loansta_{t-1}$ | | 0.064*** | (7.85) | 0.058*** | (3.70) |
| $Size_{t-1}$ | | −0.050*** | (−6.60) | −0.036*** | (−5.32) |
| $Sav\_rate_{t-1}$ | + | 7.500*** | (7.34) | 3.376** | (2.09) |
| Observations | | 4,369 | 4,228 | | |
| R-squared | | 0.631 | 0.648 | | |
| **Panel B: Alternative specification** | | | | | |
| **Subsample:** | | **First quartile—*finlit*** | | **Fourth quartile—*finlit*** | |
| **Dependent variable** | | ***ΔS&D*** | | ***ΔS&D*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $NIM_{t-1}$ | + | 0.145 | (0.22) | 0.913** | (2.03) |
| $Charge\text{-}offs_{t-1}$ | − | −0.763*** | (−2.96) | −0.684*** | (−2.17) |
| Observations | | 4,369 | | 4,228 | |
| CU controls | | YES | | YES | |
| *R*-squared | | 0.641 | | 0.645 | |
| CU FE | | YES | | YES | |
| State × time FE | | YES | | YES | |

*Notes*: Fixed-effects panel regressions of shares and deposits growth on CU characteristics controling for the effect of financial education. The sample starts in 2009 and is restricted to community credit unions. Column 1: subsample composed of CUs that operate in 3-digit zip codes with financial literacy measure in the first quartile (lowest 25% values of *finlit*); column 2: subsample is composed of CUs that operate in 3-digit zip codes with financial literacy measure in the fourth quartile (highest 25% values of *finlit*). Panel A: main specification. Panel B: Alternative specifications where *ROA* and *NPL* are replaced by *NIM* and *Charge-offs*. Both panels are estimated with CU and state × time fixed effects. See Appendix A for variable definitions. *t*-statistics are based on DK standard errors (with 4 lags) clustered by CU and quarter.

*, **, *** denote significance (based on two-tail tests) at 10%, 5% and 1% level.

**TABLE 8** The effect of measures of capacity to process information—Income measures

| **Panel A: Main specification** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | **(1)** | | **(2)** | | **(3)** | | **(4)** | |
| **Subsample:** | | ***LID* = 1** | | ***LID* = 0** | | **Fourth quartile County income per capita** | | **First quartile County income per capita** | |
| **Dependent variable** | | ***ΔS&D*** | | ***ΔS&D*** | | ***ΔS&D*** | | ***ΔS&D*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** |
| $ROA_{t-1}$ | + | 0.492*** | (3.18) | 0.692*** | (9.51) | 0.282 | (1.01) | 0.381* | (5.45) |
| $sdROA_{t-1}$ | − | 0.000 | (0.09) | 0.001 | (1.62) | 0.002* | (1.77) | −0.001 | (0.10) |
| $PL_{t-1}$ | − | −0.002** | (−2.52) | 0.000 | (0.38) | −0.001 | (−0.62) | −0.002* | (0.10) |
| $PL_{t-1} \times sdROA_{t-1}$ | − | −0.000 | (−0.97) | −0.001*** | (−4.95) | −0.001* | (−1.93) | −0.000 | (−1.33) |
| $NWTA_{t-1}$ | + | 0.261*** | (7.39) | 0.155*** | (9.49) | 0.095** | (2.49) | 0.187*** | (4.04) |
| $NPL_{t-1}$ | − | −0.117*** | (−3.07) | −0.234*** | (−11.40) | −0.180*** | (−3.87) | −0.224*** | (−5.10) |
| $loansta_{t-1}$ | − | 0.051*** | (9.54) | 0.039*** | (14.24) | 0.044*** | (7.05) | 0.033*** | (6.15) |
| $size_{t-1}$ | | −0.022*** | (−5.54) | −0.011*** | (−8.26) | −0.024*** | (−5.62) | −0.015*** | |
| $Sav\_rate_{t-1}$ | + | 3.322*** | (5.16) | 2.945*** | (10.56) | 2.574*** | (3.47) | 4.551*** | (2.60) |
| Observations | | 24,270 | 142,904 | 7,237 | 7,655 | | | | |
| *R*-squared | | 0.468 | | 0.468 | | 0.595 | | 0.610 | |

(Continues)

**TABLE 8** (Continued)

| **Panel B: Alternative specification** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Subsample:** | | **(1)** *LID* = 1 | | **(2)** *LID* = 0 | | **(3)** Fourth quartile County income per capita | | **(4)** First quartile County income per capita | |
| **Dependent variable** | | ***ΔS&D*** | | ***ΔS&D*** | | ***ΔS&D*** | | ***ΔS&D*** | |
| **Variables** | **Prediction** | **Coefficient** | ***t*-statistic** | **Coefficient** | ***t*-statistic** | **Coefficient** | **t-statistic** | **Coefficient** | ***t*-statistic** |
| $NIM_{t-1}$ | + | 0.253 | (0.86) | 0.653*** | (3.74) | −0.699 | (−1.36) | 0.772 | (1.02) |
| $Charge\text{-}offs_{t-1}$ | − | −0.790*** | (−4.98) | −1.463*** | (−11.30) | −1.005*** | (−3.28) | −1.663*** | (−7.27) |
| Observations | | 24,270 | | 142,904 | | 7,237 | | 7,655 | |
| CU controls | | YES | | YES | | YES | | YES | |
| CU FE | | YES | | YES | | YES | | YES | |
| State × time FE | | YES | | YES | | YES | | YES | |

*Notes*: Fixed-effects panel regressions of shares and deposits growth on CU characteristics controling for the effect of income levels. Column 1: subsample is composed of CUs with the low-income designation (*LID* = 1); column 2: subsample is composed of CUs without the low-income designation (*LID* = 0); column 3: subsample is composed of community CUs located in counties with personal income per capita in the first quartile (lowest 25%); column 4: subsample is composed of community CUs located in counties with personal income per capita in the fourth quartile (highest 25%). Panel A: main specification. Panel B: Alternative specifications where *ROA* and *NPL* are replaced by *NIM* and *Charge-offs*. Both panels are estimated with CU and state × time fixed effects. See Appendix A for variable definitions. *t*-statistics are based on DK standard errors (with 4 lags) clustered by CU and quarter.

*, **, *** denote significance (based on two-tail tests) at 10%, 5% and 1% level.

(significant vs non-significant), *NPL* (2 times higher), *NIM* (significant vs non-significant) and *Charge-offs* (1.8 times higher). Columns 3–4 contain the results from the split on the basis on personal income per capita (at the county level). For this split we also limit our analysis to community CUs, which allow us to measure more accurately member income. The results are also aligned with our expectations: the results show a stronger reaction of deposits to our main variables of interest for CUs where members have a higher income on average. This holds for *ROA* (significant—at the 10% level—for the upper quartile vs non-significant), *NWTA* (two times higher for the upper quartile), *NPL* (1.2 times higher) and *Charge-offs* (1.6 times higher).

All in all, we believe that the results shown in Tables 7 and 8 are in line with the hypothesis that financial literacy (or financial sophistication) plays a role in depositor discipline: the ability of CU members to access and process financial information is likely to impact the extent to which CU deposits react to the indicators of financial health and CU risk-taking.

## 6 | ROBUSTNESS TESTS

We performed a series of additional tests in order to gauge the robustness of our results.

1. Sample data: we replicate our main analysis (Table 2) for the universe of CUs, without restricting the analysis to those with total assets above $50 million. This forces us to restrict the sample period to 2002Q3–2018Q4 (before 2002Q3 CUs with total assets below $50 million did not report financial statements on a quarterly basis). The results—shown in Table C2 of Appendix C—are consistent with those in Table 2.
2. Growth via M&As: in our main specification we drop the CU-quarter observations corresponding to CUs that go through an M&A during that specific quarter. For robustness, we re-estimate our baseline analyses dropping from the sample all the CU-quarter observations corresponding to CUs that have been subject to an M&A, from the quarter of the M&A transaction onward. The results—shown in Table C3 of Appendix C—are, again, similar although with slightly less statistical significance (a consequence of the reduction in sample size from 167,834 to 94,548 observations).
3. Financial crisis: we estimate Table 2 for subsamples which exclude the last crisis period (Table C4 in Appendix C) and which only include the crisis period (Table C5 in Appendix C). The results do not change significantly, although there is some evidence of stronger discipline during the crisis time (a result which makes intuitive sense).
4. We re-estimated all tables (2 to 7) using CU and time fixed effects and state level macroeconomic controls instead of state × time fixed effects. The results—available upon request—did not change significantly.
5. We replicated Table 5 restricting the subsample to CUs which do not change field-of-membership during the sample period. The results, shown in Table C6 in Appendix C are consistent with those of Table 5 and, if anything, they show more evidence that deposits of occupational/associational CUs are less responsive than members of community /MFOM CUs.

## 7 | CONCLUDING REMARKS

We have analyzed whether and how CU depositors exercise a sort of discipline on the CU by reacting to increases in risk-taking or deterioration of CU fundamentals. We reviewed some of the

arguments in favor and against the existence of such discipline in CUs, which we believe serve to justify and design our sequence of analyses. We first explored whether members of CUs react to CU fundamentals and then we tried to look more closely at the mechanisms which mediate this reaction: in particular, we looked at the persistence of discipline over time, the effects of deposit insurance, the CU's field of membership and the role of financial sophistication of the CU member base.

Our results show evidence of depositor discipline exercised by CU members. Specifically, we find that measures of asset risk such as delinquent loans (*NPL*), charge-offs (*Charge-offs*) and bad performance volatility are negatively related to growth in total shares and deposits. On the other hand, CU depositors favor CUs with high net worth ratios and operating performance. Interestingly, when problems arise, in addition to the reduction in shares and deposits there is a decrease in the number of members, a result also in line with discipline. As part of the basic analysis, we also show that depositors ask for higher returns on their savings for CUs with high credit risk (nonperforming loans and charge-offs). We show that the insurance scheme greatly affects the extent of discipline, in that insured deposits react much less to all indicators than uninsured deposits. Also, our evidence suggests that the field of membership plays a role in the way discipline is exercised by CU members: while members of MFOM and community CUs react to bad and good fundamentals in ways consistent with depositor discipline, members of associational and occupational CUs do not react to indicators of credit risk. Other proxies for the strength of the CU–member relationship also are shown to be correlated with discipline. We posit that these differences in disciplining mechanisms may be explained by different levels of asymmetry of information and loyalty to the CU. Finally, our evidence on the financial sophistication of members suggests that proxies of the extent to which members are capable of processing financial information are related with the intensity of the depositor discipline.

We believe our paper significantly contributes to the literature on depositor discipline by giving a broad description of the mechanisms through which this discipline works in CUs. Also, the results of our paper have important policy implications in that they should allow supervisors to understand the peculiarities of the discipline effect in CUs. In particular, our results reinforce previous calls for improving financial literacy as a way of increasing the monitoring exercised on financial institutions and, therefore, of increasing the overall stability of the financial system.

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# APPENDIX

**TABLE A1** VARIABLE DEFINITIONS

| | Variable | Definition |
|---|---|---|
| *Dependent variables* | *S&D* | Total shares and deposits of the CU deflated by total assets. |
| | *Δshares* | Quarter-on-quarter growth of shares of the CU. |
| | *ΔS&D* | Quarter-on-quarter growth of shares and deposits of the CU. |
| | *Δunind* | Quarter-on-quarter growth of uninsured shares and deposits of the CU. |
| | *Δinsd* | Quarter-on-quarter growth of insured shares and deposits of the CU. |
| | *membersgrowth* | Quarter-on-quarter growth in the number of members of the CU. |
| *Explanatory variables* | *ROA* | Return on assets of the CU. |
| | *sdROA* | Standard deviation of *ROA* (calculated over the previous 12 quarters). |
| | *PL* | Past losses the CU computed as natural logarithm of 1 plus the number of quarters where the credit union obtained losses during the previous 12 quarters (From $t-1$ to $t-12$). This variable takes values between 0 and 2.57. |
| | *NWTA* | Net worth over total assets of the CUs. |
| | *NPL* | Total amount of delinquent loans over total loans and leases of the CU. |
| | *Charge-offs* | Quarterly charge offs over total loans and leases of the CU. |
| | *NIM* | Net interest margin of the CU. |
| | *loansta* | Total loans and leases over total assets of the CU. |
| | *size* | Natural logarithm of total assets of the CU. |
| | *Sav_rate* | Saving rate: Average interest rates on total shares and deposits paid by the CU computed as (Dividends on shares + Interest on deposits)/Total shares and deposits. |
| | *divregsh* | Average dividend rate on regular shares. |
| | *intnonmemb* | Average interest on nonmember deposits. |
| | *Nonmembdep* | Total nonmember deposits of the CU deflated by total assets. |
| *Low income and financial literacy variables* | *LID* | Dummy which takes value 1 when the CU is under the low-income designation, 0 otherwise. |
| | *finlit* | Average number of correct answers (out of five) to the financial literacy quiz conducted in 2009, 2012, 2015 and 2018 by FINRA Investor education formation in the zip code (3-digit) where a community CU operates. |