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Organizational Form and Thrift Risk During the US Housing Boom and Bust

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Abstract

We compare the performance of community-bank-sized mutual and stock thrifts during the housing boom of 2001-06 and the housing bust of 2007-13. During the housing bust, mutuals failed at a much lower rate than stock thrifts. To investigate this difference, we first estimate a probit model of thrift failure over the housing bust and show that this difference holds even when controlling for local economic shocks and differences in thrift characteristics. Furthermore, we find that a concentration in construction and land development loans is the only type of loan concentration that is predictive of failure. Second, we calculate several measures of risk during the housing boom period and find that mutual thrifts increased their risk less than stock thrifts. We compare our results with earlier studies that examined thrifts during the savings and loan crisis. In our sample, thrifts supervised by the Office of Thrift Supervision failed at a higher rate than other thrifts. However, once we account for other thrift characteristics, they did not fail at a higher rate during the housing bust nor did they take more risk during the housing boom. Finally, we also describe a class of hybrid thrifts that are mutually organized but can raise external capital and analyze their performance during the housing bust.

JEL codes: G21, G32, G38

Keywords: mutuals, thrifts, corporate governance, bank risk

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1. Introduction

The mutual form of organization has a long tradition in banking in the United States. In the 19th century, mutually organized savings and loans were formed to help members finance the purchase of a house, and mutually organized savings banks were created to provide a safe place for working class people to save. Even as late as the 1980s, a large fraction of US residential mortgages were originated and held by thrifts – the broader term for savings and loans, savings banks, and cooperative banks – that were organized as mutuals. While the thrift industry has dramatically declined in size since the savings and loan crisis of the 1980s, at the end of 2024 there were still 547 thrifts holding $1.2 trillion in assets, of which 388 were organized as mutuals. Furthermore, the credit union industry is entirely mutually organized and that industry holds $2.3 trillion in assets.

A long-standing question in corporate governance in banking is the effect of ownership structure on bank risk. This question is part of the broad literature on the impact of corporate governance and managerial incentives on firm behavior (Jensen and Meckling (1976), Fama and Jensen (1983), and Ma and Schleifer (2025)). The connection between ownership and risk is particularly important in banking due to the costs of a financial panic and the underpriced risk and moral hazard created by deposit insurance and bailouts (Merton (1977), Kareken and Wallace (1978), and Diamond and Dybvig (1983)). The thrift industry is well suited to studying this connection because the industry contains mutuals and stock corporations, both of which operate under the same set of regulations. The only differences between them are their governance and the limits on mutuals' ability to raise external capital.

This paper examines the effect of ownership structure on risk taking by thrifts during the housing boom of 2001-06 and the subsequent housing bust and global financial crisis (GFC). Despite the high-profile failures of Washington Mutual and IndyMac during the GFC and the legal requirements that thrifts concentrate their asset holdings in mortgages, the failure rate for community-bank-sized thrifts over the 2007-13 period was about 5.6 percent, which is not that different from the 5.7 percent failure rate for community banks (Balla, et al. (2019)). However, failure rates differed dramatically by form of ownership. As Table 1 reports, in our sample only 2.3 percent of mutual thrifts failed over this period, while a much higher percentage, 11.5, of stock thrifts failed.

To explain this difference, we break our analysis into two parts. In the first part, we estimate a cross-sectional probit model in which failure during the housing bust period of 2007-13 is regressed on thrift characteristics at the end of 2006 and the size of local economic shocks. This model is based on the community bank failure model of Balla et al. (2019), which in turn builds on Cole and White (2012) and an earlier literature on predictors of commercial bank failure.

Consistent with that literature, we find that lower capital and lower earnings are positively related to failure. Furthermore, we find that mutuals fail at a statistically significantly lower rate than stock thrifts even when controlling for other thrift characteristics and the size of local economic shocks.

We also find that the *only* type of lending positively associated with failure is a concentration in construction and land development (CLD) loans. Despite the subprime crisis, the housing boom and bust, and the large holdings of residential mortgages by thrifts, we find that a concentration in residential lending is statistically insignificant in predicting failure, the same result that Balla et al. (2019) found in their 2006 community bank sample. The analysis suggests that, as a group, small thrifts were not making the risky subprime and limited-documentation mortgage loans that defaulted at such a high rate in that period but instead were exposed to the housing bust indirectly through loans to developers.

The importance of a concentration in CLD lending is evident in Figure 1, which shows CLD lending concentrations over the 2001–13 period broken up by ownership structure and whether a thrift failed. Coming out of the 2001 recession, CLD lending as a share of assets was relatively low. It is lower for mutuals than for stock thrifts, but still small for both. As the boom develops, concentrations for mutuals and stock thrifts grow. Furthermore, concentrations reach a much higher level for failed stock thrifts than for surviving stock thrifts. A similar pattern is seen for mutuals, although the size of the increase is less. One implication of the differential growth in CLD lending during the housing boom is that the negative coefficient on the mutual dummy variable may understate the effect of ownership on risk because it ignores any connection between ownership and increases in risky activities like CLD lending.

The second part of our analysis addresses this connection by examining risk taking during the housing boom. Here, we add to earlier analyses of risk taking by thrifts during the savings and loan crisis of the 1980s (Cordell, Mac Donald, and Wohar (1993), Esty (1997), and

Schrand and Unal (1998)) by considering a different time period and additional risk measures. Our strategy is to view the beginning of the housing boom as a period when thrifts were relatively safe, as suggested by their low CLD concentrations in 2001. We measure how much risk each thrift took during the housing boom of 2001-06. We use several measures, and for the majority of thrifts we find that stock thrifts increased their risk significantly more than mutuals.

While mutuals fail at a lower rate, one cost for them is the limits on their ability to raise capital. Traditionally, retained earnings was the only way that a mutual could increase capital. However, the Competitive Equality Banking Act of 1987 allowed mutual thrifts to use a mutual holding corporation (MHC) structure that preserves their mutual status while allowing them to sell a minority equity interest to outside investors. In 2006, there were 67 of these in our sample. We describe this organizational structure and the differences in behavior between these thrifts held by MHCs and other mutuals.

We also use our analysis to examine other related questions. For example, most of the thrifts in our sample were supervised by either the Office of Thrift Supervision (OTS) or the Federal Deposit Insurance Corporation (FDIC), and as Table 1 shows, OTS supervised thrifts failed at a much higher rate. The OTS received plenty of criticism for its supervision of IndyMac and WaMu, both of which failed, and it was eliminated in the Dodd-Frank Act of 2010. We use our probit model and risk regressions to examine this difference in failure rates. Here, when controlling for thrift characteristics and local economic shocks, we find no evidence that OTS supervised thrifts failed at a higher rate or that they took on more risk during the housing boom than non-OTS thrifts.

2. **Background on the Thrift Industry**

The thrift industry consists of three different charters—savings and loan associations, savings banks, and cooperative banks—most of which concentrate their lending in residential mortgages.[2] Some thrifts are chartered by the federal government and others by states. They can be organized as a stock corporation or as a mutual.

Historically, there were significant differences in powers and objectives by charter. In the 19th century, savings and loan associations were developed to fund the building of houses for their members. Initially, the members owned and managed the association, but over time, this

[2] Other terms used for a thrift include savings association, building and loan association, and homestead association.

type of organization evolved to one where the members were depositors who elected a board of directors to run the organization. In contrast, mutual savings banks were organized by philanthropists to provide a safe place for working-class people to save. The bank had a self-perpetuating board of trustees or directors that was not elected by the depositors. The only mutual aspect of savings banks was that depositors had a claim to the bank's earnings and any proceeds from liquidating it.[3] The cooperative bank charter is unique to parts of New England. It was first created in Massachusetts in the late 19th century and was similar to the mutual savings and loan association charter (Davenport (1938)). One difference from savings and loans was that in a cooperative there was one vote per depositor rather than one vote per deposit as in mutual savings and loans. In our 2006 sample, one cooperative bank was located in New Hampshire and the other 68 were in Massachusetts.

Regardless of these historical differences, the distinctions between the powers granted by different charters have tended to blur over time.[4] For reasons discussed in Teck (1968), including changes in the tax code and the introduction of the Home Owners' Loan Act of 1934 (HOLA), by the mid-20th century, savings banks concentrated in residential mortgage lending just like savings and loans. Furthermore, often in reaction to financial problems due to the high inflation and financial innovations of the 1970s and the ensuing savings and loan crisis of the 1980s, the federal government made legal and regulatory changes allowing thrifts to gain some commercial bank powers. For example, federally insured thrifts were allowed to issue demand deposits in the early 1980s.[5]

By the early 2000s, there were few significant differences between thrift charters, but two significant ones remained between thrifts and commercial banks.[6] First, by law and regulation, most thrifts concentrated in loans related to residential mortgages. Savings and loans and federal

[3] For histories of savings and loans and savings banks, see Teck (1968), Bensten (1972), and Moysich (1997).
[4] Some of the historical governance differences have changed as well. In most federally chartered savings banks, the depositors elect the board of directors. In much of New England, in state-chartered mutual savings banks, the board of trustees–similar to a board of directors–is not elected by depositors, but instead by a board of corporators. In many mid-Atlantic states, state-chartered mutual savings banks are governed by a board of trustees who elect themselves (Luse (2005)). Also, some mutual savings banks can now have one vote per depositor (Office of the Comptroller of the Currency (2014)).
[5] For a history of thrift powers, see Greenlee (2021). For histories of the savings and loan crisis, see Kane (1989) or White (1991). Furthermore, while the term "savings and loan" is associated with that crisis, mutual savings banks were also a significant part of that crisis (Moysich (1997)).
[6] The Federal Deposit Insurance Corporation (1997) reports that, by 1997, there were no differences in powers between federally chartered savings and loans and savings banks.

savings banks were required to do a minimum amount of residential mortgage lending by HOLA. Furthermore, many state-chartered thrifts would meet the qualified thrift lender test, which requires concentrations in residential lending, to be members of the Federal Home Loan Bank System.

Second, unlike commercial banks, thrifts could still be organized as mutuals, and despite the many conversions over time, of the roughly 1160 thrifts in our 2006 sample, 743 of them were still mutuals. Furthermore, despite the continued decline of this sector, at the end of 2024 there were still 547 thrifts, of which 388 are mutual and 159 are stock owned.[7]

One class of thrifts that we do not include in our study are thrifts owned by non-thrift-related holding companies, such as nonprofits, fraternal organizations, non-financial companies, securities brokers, and insurance companies. Unlike with commercial banks, non-banks have long been allowed to own thrifts, although the exact restrictions on ownership have changed over time.[8] Because many of these thrifts operate differently than a traditional thrift and have an external source of support, we do not include them in our analysis.

During most of the time period of this study, all federally chartered savings banks and all savings and loan associations were supervised by the Office of Thrift Supervision (OTS), and almost all of the remaining state-chartered savings bank and cooperatives were supervised by the FDIC and the supervisors within their state. Only five of these state-chartered thrifts were supervised by the Federal Reserve.[9]

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[7] National banks cannot be organized as mutuals. However, the Economic Growth, Regulatory Relief, and Consumer Protection Act of 2018 allowed for federally chartered thrifts that have under $20 billion in assets to elect to operate with the same powers and limitations as national banks and not be subject to the thrift lending restrictions, while still operating under their governance rules in effect before the election. Furthermore, the depository can maintain its election even if it grows above $20 billion assets. So, even though national banks cannot be organized as mutuals, there can now be mutually organized federal thrifts that for almost all intents and purposes are national banks.

[8] Historically, the restrictions on who could own a thrift were less onerous than those for a commercial bank, and even companies that engaged in commerce could own a thrift, although this changed over time. The Savings and Loan Holding Company Act of 1968 put more restrictions on a company that owned or controlled two or more thrifts. However, these restrictions did not apply to a company that owned a single thrift, which created the so-called unitary-thrift exemption. The Gramm-Leach-Bliley (GLB) Act in 1999 eliminated this exemption, but grandfathered existing unitary thrifts. GLB also relaxed the separation between banking and insurance, and some insurance companies entered banking by acquiring or creating a thrift. The 2010 Dodd-Frank law transferred supervision of these holding companies from the OTS to the Federal Reserve, and because the Federal Reserve regulates and supervises holding companies differently than the OTS did, many of these savings and loan holding companies decided to divest themselves of their thrift. For more details and history on the ownership restrictions of thrifts, see Greenlee (2021).

[9] The 2010 Dodd-Frank law eliminated the OTS and on July 21, 2011 supervision of federal savings associations was transferred to the Office of the Comptroller of the Currency (OCC) and the state-chartered thrifts that the OTS

Finally, the most significant disadvantage of mutually organized depository institutions is that they cannot raise external capital. Traditionally, the only way they could raise capital is through retained earnings or converting to stock. For this reason, mutuals tend to maintain a higher level of capital to provide a buffer. However, starting in the late 1980s, mutual thrifts were able to raise capital if they adopted a two-tier mutual holding company structure and sold a minority interest in the firm. Later, we will discuss this type of capital and document how extensively it is used by mutual thrifts.

3. Literature

The literature on ownership and risk in banking consists of two interacting principal-agent problems. The first one is the problem between the bank regulator and the bank. Due to deposit insurance, bailouts, and moral hazard, deposit rates need not reflect bank risk, and most of the ex post costs of a bank failing are borne by the deposit insurer. Consequently, equity owners of a bank do not bear their full ex ante cost for taking risk. An implication of this distortion is that it amplifies the positive relationship between bank risk and the value of equity (Merton (1977) and Kareken and Wallace (1978)). These effects can be mitigated by bank capital or bank franchise value because equity owners then have more to lose from failure than they would otherwise (Keeley (1990)) or by regulation and supervision (Buser, Chen, and Kane (1981)). Still, the perverse incentive exists, particularly when a bank is low on capital. This distortion, which can encourage risk taking, is sometimes referred to as the risk-shifting problem in the banking literature.

The second principal-agent problem is the one between the owners of a bank and its managers (Jensen and Meckling (1976), Fama and Jensen (1983), and Ma and Schleifer (2025)). Managers' interests may diverge from those of equity owners for reasons such as a desire to enjoy job-related perks, a desire to avoid risk to preserve their jobs, or a desire to empire-build.[10] These divergences differ between a stock firm and a mutual firm. In a stock firm it's possible that the interests of managers and equity owners could be aligned through compensation

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had supervised to the FDIC. Prior to the transfer, the FDIC only supervised state-chartered savings banks and cooperative banks.

[10] Ma and Schleifer (2025) give a broad history of thought on corporate governance and discuss the various managerial incentive problems that have been analyzed over time. An example of a paper on corporate governance of stock thrifts is Borochin and Knopf (2021)) who study insiders' ownership pre- and post-thrift IPOs and find that insiders' preferred level of ownership is consistent with control and entrenchment.

contracts that include equity or equity options. Furthermore, if the firm's stock is traded, then the threat of a takeover puts pressure on managers to maximize the value of equity; otherwise, they may lose control of a firm.[11,12]

In contrast, neither of these mechanisms operate in a mutual firm. The managers of a mutual face little outside pressure to increase value. A mutual does not have stock to trade, and depositors cannot sell their ownership interest in the mutual unless the mutual's managers decides to sell the entire thrift. Furthermore, it is difficult to remove the managers of a mutual, unless it is failing. Typically, depositors either don't vote or give their votes to management by proxy. The result is that unless the mutual is near failure, the managers are unlikely to be voted out of office or replaced by regulators.[13]

As a result, the managers can operate the mutual for their own benefit. While this may be inefficient, it does reduce the risk-shifting incentive in the principal-agent problem between the bank regulators and the bank. With the loss of future compensation if the mutual fails, the manager of a mutual has an incentive to take less risk than the manager of a stock thrift. For these reasons, the thrift literature views the managers of mutuals as having incentives to reduce risk, with the main managerial incentive problems being excessive compensation and inefficiency due to an inability to replace poor managers (Nichols (1967), Hermann (1969), Rasmussen (1988), and Esty (1997)).[14]

The literature from the 1960s, during the quiet period in banking when few banks or thrifts failed, focused on excessive compensation, self-dealing, and inefficiency as the main principal-agent problem associated with mutuals. In contrast, much of the literature on thrifts that arose from the savings and loan crisis focused on the risk-shifting problem. During this period, due to the weak conditions of many thrifts, legal and regulatory constraints on conversions and

[11] The presence of a regulator may affect the takeover dynamic. Cook, Hogan, and Kieschnick (2004) find evidence that the OTS censure of weak thrifts displaced the disciplinary role of takeovers.
[12] In banking, the literature on the separation of ownership and control has focused narrowly on the compensation contracts offered to bank CEOs or compared the performance of different classes of banks. For example, Balla and Rose (2019) compare the performance of privately owned and publicly traded commercial banks, while Laeven and Levine (2009) look at the degree to which ownership is widely held.
[13] See Nichols (1967) and Brigham and Pettit (1969).
[14] Inefficiencies may change in time due to changes in regulations, powers, and competition. Mester (1991) found evidence of inefficiencies—in the form of producing an inefficient output mix—for mutual S&Ls operating in California during 1982. In subsequent work, Mester (1993) examined S&Ls operating in 1991, which followed a decade of deregulation and increased competition, and found that stock S&Ls were on average less efficient than mutuals.

thrift activities were significantly reduced in an attempt to allow them to recapitalize. Furthermore, regulators practiced extensive forbearance. As a result, there were many mutual-to-stock conversions, and risk-shifting opportunities for stock thrifts increased.

Cordell, Mac Donald, and Wohar (1993) compared stock, mutual, and converted savings and loans over the 1981-89 period. They regressed several measures of risk on dummy variables for ownership and conversion. They found that stock thrifts and those that converted prior to 1980, when there were fewer restrictions on management following a conversion, were riskier than mutuals.[15] Esty (1997) compared stock and mutual thrifts over the 1982-88 period. Using different measures of risk than Cordell, Mac Donald, and Wohar (1993), he also found that stock thrifts were riskier than mutuals. In addition, he found that converting thrifts changed their asset mix to increase their risk.

The second strand of the literature to which our research is connected is models of bank failure, particularly those of community banks. We will follow Balla et al. (2019) in their use of a cross-sectional probit model that regresses bank characteristics right before the financial crisis and sizes of local economic shocks on failure over an extended period. Balla et al. (2019) in turn built on a series of analyses of bank failures, which include work by Cole and Gunther (1995), Fenn and Cole (2008), Cole and White (2012), and Wheelock and Wilson (2000), who found that commercial real estate lending concentrations were important predictors of bank failure. Our analysis also includes analysis of the importance of the size of economic shocks, which was considered by Schaeck (2008) and Aubuchon and Wheelock (2010). Most of that literature used samples of commercial banks rather than thrifts; so our analysis complements that work. Furthermore, much that literature is focused on predicting failure or weak banks, while our analysis also considers choice in risk taking. We are unaware of any analysis of thrift failure or thrift risk taking during the period we study.

[15] Another dimension to the conversion decision is capital distribution behavior. Kroszner and Strahan (1996) examined mutual to stock conversions over 1979-92. During this period, many thrifts were insolvent. The thrift regulator did not have the resources to resolve them, so it encouraged conversion as a way to bring capital into the industry. Kroszner and Strahan (1996) found that during this period,insolvent and near-insolvent thrifts paid out dividends rather than retaining earnings. Related to this finding is Akerlof and Romer (1993), who develop a model where owners of a firm can extract wealth from debtors and taxpayers by making payments like dividends if conditions such as inflated net worth and limited liability exist. They used insolvent savings and loans that were kept open by the forbearance policies of the 1980s as one of their prime examples of this mechanism.

4. Data

We use two closely connected samples for our analysis. The first sample consists of thrifts that existed in 2006:Q4, had under $10 billion in assets in 2006:Q4, were chartered in a US state or the District of Columbia, and were not recent *de novo* institutions, that is, had been in existence for at least 20 quarters. We use the $10 billion asset threshold because that is commonly used to define a community bank, and we exclude recent *de novo* institutions because the literature finds that *de novo* commercial banks have different risk characteristics (DeYoung (2003)). We also refer to this sample as the housing bust sample.

We take all Thrift Financial Report filers–which can be chartered as savings and loan associations (S&Ls) or savings banks—and add Call Report filers chartered as savings banks or cooperative banks.[16] In our sample, 69 percent of thrifts have a savings bank charter, 25 percent have an S&L charter, and 6 percent have a cooperative bank charter. By ownership type, 64 percent of thrifts are mutually owned.

To focus on traditional thrifts, we exclude thrifts for which total loans were less than 5 percent of total assets and book capital exceeded 50 percent of total assets, and thrifts that held no 1-4 family real estate loans. We also exclude thrifts owned by non-thrift-related holding companies, such as nonprofits, fraternal organizations, utilities, securities brokers, and insurance companies. This resulted in dropping 123 thrifts. The resulting sample includes 1,160 thrifts in 2006:Q4, of which 65 had failed by the end of 2013.

We identify failures using the FDIC's Failed Bank List, which includes data on failed thrifts. We count a thrift as failed even if it converted to a commercial bank or another charter type before failing within the 2007-13 period. Tables 2a-2e report summary data for this sample broken out into various categories.

Our second sample consists of thrifts that existed in 2001:Q4. We use $6.64 billion as our size threshold, which is the $10 billion size threshold we used for the 2006:Q4 sample deflated by the growth in banking sector (commercial and thrift banks combined) assets. We include only thrifts that were chartered in US states and the District of Columbia in 2001:Q4. We drop thrifts

[16] Until 2012, OTS supervised thrifts filed the Thrift Financial Report, while thrifts supervised by the FDIC and the Federal Reserve filed the same Call Report that commercial banks file. There are differences between the reports, and our data appendix describes how we mapped the variables from one report to the other. With the elimination of the OTS in 2011, the TFR was discontinued, and all thrifts started filing a Call Report in 2012.

that would be considered *de novo* in 2001:Q4 by our 20-quarter age definition. As above, we drop thrifts with non-thrift-related holding companies and those that exceeded the various thresholds described above as of 2001:Q4.[17] This leaves us with 1,344 observations for this sample, which we refer to as our housing boom sample.

Finally, for both data sets we adjust our income data for mergers. When a thrift acquires another depository institution, neither the Call Report nor the TFR include the acquired institution's pre-merger income in the acquirer's report. We add the pre-merger income to the acquiree's income so that our annual income variables, which are all defined relative to assets, are comparable across thrifts.

4.1 Variables for the Housing Bust Sample

Size and liabilities variables

The variable $Size_{06}$ is the natural logarithm of total assets, measured in thousands of dollars. The variable $Capital_{06}$ is book equity divided by total assets. *Uninsured Deposits* is uninsured deposits divided by total assets. In 2006:Q4, Thrift Financial Report and Call Report filers with over $1 billion in total assets were required to estimate the amount of their uninsured deposits. We use this estimate for thrifts that report uninsured deposits. For smaller thrifts, we estimate uninsured deposits based on the number and amount of deposit accounts above the deposit insurance limit.[18]

Lending and other asset variables

All asset variables are normalized by total assets. We measure several types of real estate lending. The variable *1-4 Family Real Estate Loans* includes mainly residential mortgages. The variable *CLD Loans* indicates loans made to develop land and undertake construction. *Other Real Estate Loans* includes remaining commercial real estate loans and loans secured by multifamily units.[19]

Performance variables

To account for thrift performance, we use measures of asset quality, income level, income variability, and asset growth. For asset quality, we use *Nonperforming Assets*, which is calculated

[17] One thrift was dropped due to reporting problems with its income in 2001.
[18] In 2006:Q4, the deposit insurance limit was $250,000 for retirement accounts and $100,000 for other accounts.
[19] We did not include agricultural, consumer, or commercial and industrial lending because the median thrift in our sample does very little of any of these types of lending.

by adding loans that are 30-89 days past due, 90+ days past due, and those on nonaccrual status, to other real estate owned and dividing by total assets. The $Earnings_{06}$ variable is calculated by dividing net income by total assets. We measure *3-Year Asset Growth* by dividing the growth in total assets from 2003:Q4 to 2006:Q4 by total assets in 2003:Q4.

We also analyze the connection between thrift characteristics and the performance of residential mortgage lending. Due to differences in the timing of thrift failures, we use as our measure the highest non-performing ratio for 1-4 family mortgages between 2007 and 2013 for surviving thrifts and between 2007 and the date of failure for those that fail. We call this variable *Max Family Nonperforming*.

Discretionary accounting variables

We include two variables that reflect loan accounting decisions on the part of thrift management. The first variable is *Interest Receivable*, which is an asset on the balance sheet that captures interest income that has been accrued but not yet been received. The second variable is *Loan Loss Reserve*, which is an asset on the balance sheet representing reserves held for expected losses on loans. These two variables are expressed as a share of total assets.

Economic shock variables

We use two variables to measure the economic shocks that a thrift experiences during the seven-year period. For each thrift, the size of the shock is determined by the state in which it was headquartered in 2006:Q4. *Unemployment Increase* measures deterioration in the state-level labor market. It is calculated by taking the largest increase in the monthly state-level unemployment rate over any subperiod from 2007-13. *Peak to Trough* measures the deterioration of real estate conditions. It is calculated as the largest decrease in the Federal Housing Finance Agency's monthly state-level house price index over any subperiod from 2007-13.

Ownership and supervisor variables

We use two dummy variables to capture a thrift's ownership type and supervisor. Our measure of ownership type is $Mutual_{06}$, which is a dummy variable equal to one if the thrift is mutually owned as of 2006:Q4. Thrifts can assume a few different organizational structures, but they ultimately involve mutual ownership, stock ownership, or some combination of the two. Thrifts with mutual holding companies sometimes exhibit both forms of ownership. In constructing this variable, we consider any thrift with a mutual holding company to be mutually owned, even if the mutual holding company does not own all of the stock issued by the

underlying thrift or intermediate holding company. We used multiple data sources to determine each thrift's ownership type and create the $Mutual_{06}$ variable to indicate the thrift's mutual status in 2006.[20] We also define a variable OTS_{06}, which is a dummy variable equal to one if the thrift was supervised by the OTS in 2006. Because only five thrifts were supervised by the Federal Reserve in 2006, we lump these thrifts with the ones supervised by the FDIC.

4.2 Variables for the Housing Boom Sample

For this sample, we use several variables as controls that might be correlated with a desire or ability to take risk. The control variables are as follows: $Size_{01}$ is the natural logarithm of total assets in 2001:Q4, measured in thousands of dollars. $Capital_{01}$ is book equity divided by total assets in 2001:Q4. $HPI\ Growth_{01\text{-}06}$ is the percentage change in the HPI, expressed in decimal points, of the state in which the thrift was headquartered in 2001:Q4 over the 2001:Q4 to 2006:Q4 period.[21] $Mutual_{01}$ is a dummy variable indicating the ownership status of the thrift as of 2001:Q4.[22] OTS_{01} is a dummy variable indicating whether the thrift was regulated by the OTS in 2001:Q4.

We will also use several variables for a selection equation to deal with potential selection bias. $Earnings_{01}$ is earnings to assets in 2001. $Loan\text{-}to\text{-}Assets_{01}$ is the loan-to-asset ratio in 2001:Q4. $Cash\ and\ Due\ From_{01}$ is holdings of cash items in collection, unposted debits, currency, coin, and balances due from depository institutions and central banks in 2001:Q4.

In the housing boom analysis, we use several different measures of risk. *Chg in CLD* is the change in asset share of CLD lending between 2001:Q4 and 2006:Q4, expressed in decimal points. A change in share from 2.0 percent to 5.5 percent would correspond to a value of 0.035. *5-Year Asset Growth* is the percentage asset growth between 2001:Q4 and 2006:Q4 expressed in terms of decimal points. *Average Brokered Deposits* is the average share of assets that are brokered deposits over the 2002:Q1 to 2006:Q4 period expressed in decimal points. *5-Year Z-Score* is the Z score calculated by taking the thrift's capital in 2006:Q4 and its mean and standard deviation of earnings calculated over the 2002:Q1 to 2006:Q4 period. The Z-score variable is

[20] The data appendix describes how we identified mutuals.
[21] For this sample, we use a thrift's headquarters location in 2001:Q4.
[22] As in the other sample, a stock thrift that is in a mutual holding company is treated as a mutual.

intended to measure the probability of an institution becoming insolvent, based on its present condition and earnings history.[23]

5. Thrift Failure Results

The first part of our analysis identifies what type of lending and other thrift characteristics are predictive of failure over the 2007-13 period. Later, we will use these results to identify the connection between ownership and risk taking during the housing boom years of 2001-06.

To identify predictors of failure, we estimate a cross-sectional, probit model that regresses failure over the 2007-13 period on thrift characteristics as of 2006:Q4 and the size of local economic shocks over the 2007-13 period. Our strategy takes the view that decisions made during the housing boom have a large impact on the ultimate failure of a thrift. The regression is based on Balla et al.'s (2019) model of community bank failures. We use variables similar to those in their study but change some of them to account for limitations on the information reported in the Thrift Financial Report.[24] Tables 2a-e report summary statistics for the variables we used in this housing bust sample.

Table 3 reports the probit regression results. Consistent with the literature, we find that higher $Capital_{06}$ and $Earnings_{06}$ lower the probability of failure, while higher *Non-performing assets* raises it.[25] All three of these variables indicate something about a thrift's condition near the end of the housing boom; so their sign and significance is not surprising. Also not surprising is that the size of economic shocks in the form of unemployment increases and drops in the house price index are both positive and significant.

Interestingly, we find that despite the GFC being driven by a housing crisis, concentration of *1-4 Family Real Estate lending* is not statistically significant in predicting

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[23] The Z-score is often used in studies of bank risk; for example, see Boyd and Graham (1986). It is calculated as the mean earnings to assets ratio over the last n quarters plus the current book capital ratio (excluding goodwill), divided by the standard deviation of earnings to assets over the last n quarters. Often, n is set to 12, but other ranges are sometimes used; we use 20 quarters to cover the entire period of the housing boom. The Z-score measures how large a negative shock to earnings–in terms of the number of standard deviations–would cause the firm to be insolvent. A high Z-score means the bank is safer.

[24] For example, the TFR does not report the amount of time deposits below $100 thousand (the deposit insurance limit in 2006), which is traditionally a component of measures of core deposits. Consequently, we used other measures of deposits.

25 Our main results are robust to a number of alternative specifications that include share of assets that are securities, a three-year Z-score measure of risk, and concentrated lending.

failure. Instead, the only type of lending that is statistically significant in the pooled regression is *CLD Loans*. The significance of this type of lending is robust to every specification we tried. The riskiness of construction and land development lending has long been noted in the literature (Fenn and Cole (2008), Cole and White (2012)). Balla et al. (2019) found that this form of lending was highly predictive of failure for their community bank samples in both the 1985-92 and the 2007-13 periods. This analysis, along with Balla et al.'s (2019) findings, suggests that small thrifts and commercial banks were not exposed to the housing and mortgage bust directly through making risky subprime mortgages, but indirectly through their CLD lending to developers.

Some additional analysis illustrates just how important CLD concentrations were to failure risk. Table 4 reports the number of thrifts by charter with *CLD Loans* of at least 20 percent. Roughly, 25 percent of these thrifts failed, and the failed ones comprised almost a third of all failures.

We also find that the *Interest Receivable* variable is positive and statistically significantly associated with failure. This variable can reflect discretionary choices on the part of thrift management to delay putting loans on nonaccrual status and to continue accruing income on them. This temporarily hides losses and temporarily raises earnings. This variable has been identified as predictive of large FDIC losses on failed commercial banks (Bovenzi and Murton (1988), James (1991), and Osterberg and Thomson (1995)) and predictive of failure (Balla et al. (2019)). This study provides additional evidence that this variable indicates potential weakness in a depository institution, although as we will see in the subsample analysis, it does not predict failure in our stock subsample.

The $Mutual_{06}$ variable is negative and statistically significant in all of our specifications. This result is consistent with the historical evidence that mutuals fail less often than stock thrifts. However, what our multi-variate analysis adds to the simple comparison is that mutuals fail less often even when taking into account other characteristics of thrifts and the size of local economic shocks.

As a robustness check, we also investigated a specification with an interaction effect between mutual status and OTS supervision. This regression is reported in column (5) of Table 3. Due to the choice of dummy variables and the interaction effect, the omitted class of thrifts is stock thrifts that are not supervised by the OTS.

The difference between non-OTS supervised mutuals and stock thrifts is equal to the coefficient on the $Mutual_{06}$ dummy variable. It is negative and significant, which is consistent with the other regressions. The second comparison is between OTS supervised mutuals and stock thrifts. To assess this difference, we test the linear combination of coefficients on the dummy and interaction variables. This combination is reported in column (5) of Table 3 in the row labeled $Mutual_{06}$+ $Mutual_{06}$*OTS_{06} and while negative it not statistically significant. There is a large difference in raw failure rates between these groups; that is, the failure rate for OTS stock thrifts is 12.7 percent and for OTS mutuals it is 2.9 percent. Apparently, other characteristics of thrifts explain much of this difference in failure rates. For example, many OTS stock thrifts had large concentrations in CLD lending. Table 4 reports the number of thrifts by organization form and supervisor that had a CLD concentration of over 20 percent. There were 55 OTS stock thrifts with a concentration over 20 percent and 16 of them failed. In contrast, there were only three OTS mutuals with that high a concentration.

Finally, one variable that is insignificant is *3-Year Asset Growth*. Fast growth is often pointed to as a sign of risk taking in banking (Cordell, Mac Donald, and Wohar (1993) and Fahlenbrach, Prilmeier, and Stulz (2018)). Here, in our pooled sample, while the sign is positive, it is statistically insignificant. However, if we only consider whether a thrift acquired another depository institution in the last three years, we do find a positive and significant effect. (This regression is not reported.) We will return to a discussion of growth and risk in our analysis during the boom.

5.1 Marginal Effects

We evaluate the marginal effects of the independent variables to ascertain the relative importance of the different variables using the specification in Table 3, column (2). We do this by first calculating the failure rate when each variable is set to its sample mean. Due to the non-linearity of the probit and because most of the sample does not fail, the probabilities of failure evaluated at sample means are 2.47 percent, which is significantly lower than in the sample. We then calculate the effect on failure rates of making a one standard deviation change in each variable in the direction that increases the probability of failure. For *CLD Loans* this means that

we increase the size of the variable. For *Capital*$_{06}$ this means we lower the size of the variable.[26] For the *Mutual*$_{06}$ dummy, instead of changing it by one standard deviation, we simply set the value to 0, which means treating all thrifts as stock owned.

Table 5 reports the size of these marginal impact calculations. The largest quantitative impact is *CLD Loans*, *Capital*$_{06}$, and *Mutual*$_{06}$. The first two variables raise failure rates by around 220 basis points, while making all the mutuals to be stock would raise failure rates by 191 basis points. Other significant variables that have effects of at least 100 bp are *Earnings*$_{06}$, *Nonperforming assets*, *Interest Receivable*, and the two economic shock variables, *Unemployment Increase* and *Peak to Trough*.

5.2 Role of the Regulator

Failure rates were much higher for thrifts supervised by the OTS than by other regulators (primarily the FDIC). OTS supervised thrifts failed at a rate of 7.2 percent, and non-OTS thrifts failed at a rate of 2.8 percent. We investigated this difference by including a dummy variable for thrifts supervised by the OTS in 2006.[27] This regression is reported in column (4) of Table 3. The coefficient on this variable was insignificant. One reason for this negative finding is that the relative failure rate for stock versus mutual OTS supervised thrifts is 4.3, which is similar to relative failure rate for stock versus mutual non-OTS supervised thrifts of 5.1. And, accordingly, the *Mutual*$_{06}$ dummy variable remained negative and statistically significant.

The interaction effect regression, column (5) in Table 3, lets us compare OTS and non-OTS supervised thrifts conditional on organizational form. The difference between OTS mutuals and non-OTS mutuals is the linear combination of the coefficients *OTS*$_{06}$+ *Mutual*$_{06}$**OTS*$_{06}$, which is reported in column (5) of Table 3. This linear combination of coefficients is insignificant. Similarly, the final comparison between OTS stock thrifts with non-OTS stock

[26] A probit can be viewed as calculating a latent variable that, when evaluated as a cumulative standardized normal distribution centered at zero, gives the probability of the dependent variable being one. In a sample where most observations have a dependent value of zero–in this application that means not failing–the value of the latent variable for most of the observations will be less than zero, which is in the convex portion of the distribution. Consequently, an *increase* in a variable like capital that decreases the probability of failure will show a smaller effect than a *decrease* in that variable. So, to be consistent in the direction of failure, we change each variable in the direction that increases failure.

[27] Even though the OTS was eliminated in 2011 and some of our failures occurred after that date, our view is that the decisions that primarily contributed to a thrift's failure during the housing bust were made during the housing boom and, accordingly, most of the impact of a thrift's supervisor on its probability of failure would have been made during the housing boom period.

thrifts, which is the coefficient on OTS_{06}, is also statistically insignificant. Both results are consistent with our main regressions without the interaction effect. Furthermore, in our subsample analysis, discussed later and reported in Table 6, the OTS dummy is insignificant in our stock subsample regression.

5.3 Subsample Analysis

Our pooled regression treated each variable as having the same effect, but differences between mutual and stock thrifts could lead to these variables having different effects on the probability of failure. For this reason, we run our probit regression on the mutual and stock subsamples separately.

Table 6 reports the sign and significance of these coefficients compared with the pooled regression. There are only two significant differences. In the mutual subsample, the coefficient on loan loss reserves is negative and significant. In the pooled and stock samples, the coefficient is positive and insignificant. The negative coefficient is consistent with Balla et al. (2019), who found that higher loan loss reserves predicted a lower failure rate for community banks over the 1986-92 and 2007-13 periods. One possible explanation for this finding is that higher loan loss reserves indicate that a depository institution is more proactive in preparing for potential losses; therefore, the reserves act like additional capital and possibly signal more prudent management. Mutuals with a limited ability to raise external capital will have a stronger incentive to hold reserves than stock thrifts.

Another possibility is that different regulators had different policies toward loan loss reserves. We investigated this in the stock subsample by including the OTS_{06} dummy variable but found no statistically significant effect. We also tried an interaction with the OTS_{06} dummy and *Loan Loss Reserve*, but that was insignificant too.

6. Ownership Structure and Risk Taking During the Housing Boom

The probit analysis found that mutuals failed less often than stock thrifts even when taking into account other thrift characteristics and local economic shocks. While this finding is consistent with a connection between ownership and risk taking, it says nothing about the connection between ownership and the choice of how much risk to take. For example, as Figure

1 illustrates, stock thrifts grew CLD lending more than mutual thrifts. The probit regression does not address that choice.

To evaluate the connection between ownership and risk decisions, we use the timing of the housing boom. As Figure 1 shows, thrifts were doing little CLD lending at the end of 2001, which was right after the 2001 recession ended. Because CLD lending is risky, as our failure model and the literature finds (Fenn and Cole (2008), Balla et al. (2019)), we use the housing boom period of 2001-06 to assess if there is a statistical relationship between ownership and an increase in CLD concentration. We use *Chg in CLD*, which is the increase in the share of assets that are CLD loans between 2001:Q4 and 2006:Q4. We interpret large increases in *Chg in CLD* as evidence of risk-taking behavior.[28]

We also consider three other commonly used measures of bank risk. These are *5-Year Asset Growth* because fast growth is often associated with bank risk (Fahlenbrach, Prilmeier, and Stulz (2018)), the natural log of *5-Year Z score*, and *Average Brokered Deposits*.[29] We use the latter measure because brokered deposits have long been associated with bank and thrift risk (Federal Deposit Insurance Corporation (2011) and Cole and White (2012)).

We regress these four risk measures on $Mutual_{01}$, $Size_{01}$, $HPI\ Growth_{01\text{-}06}$, $Capital_{01,}$ and OTS_{01} for the portion of our sample that survived over the entire 2001:Q4 to 2006:Q4 period. We include size in 2001 as a control because larger banks often act differently than smaller ones, and we include house price growth to capture possible growth in demand for loans. We include capital as a control because low capital is often associated with risk taking. We also include the OTS dummy to complement our earlier analysis. Table 7 reports summary statistics for these risk measures and the controls in our housing boom sample.

We run ordinary least squares on all of the risk measures except *Average Brokered Deposits*. For that one, we run a series of probit regressions where the dependent variable is a one if a thrift's average brokered deposits are above 0 percent, 5 percent, or 10 percent. We run a probit because about 70 percent of our sample never used brokered deposits during our sample period. Furthermore, among thrifts that used brokered deposits, the distribution is highly skewed.

[28] Here, we are following Cordell, Mac Donald, and Wohar (1993), who used share of assets that are real estate and non-QTL lending as their metrics for risky lending.

[29] The use of the Z-score is related to Esty (1997), who considered a measure of standard deviation in quarterly revenue. We take the log because the Z-score is highly skewed, and without this transformation, residuals are not normally distributed.

We report the results in Table 8, although for the brokered deposit probit we only report the results when 0 percent is used as the threshold. In all of the regressions, the sign on the $Mutual_{01}$ coefficient is in the direction that decreases risk and is statistically significant. The coefficient on this variable in column (1) indicates that a mutual increased its CLD share by roughly 180 bp less than a stock thrift.

$Size_{01}$ is positive and statistically significant for all four regressions. It increases risk in all of the regressions except for the Z-score measure (column (3)). $Capital_{01}$ is statistically significant and lowers risk in all four regressions, and $HPI\ Growth_{01\text{-}06}$ is only positive and significant for the asset growth regression in column (2). OTS_{01} is statistically significant for the asset growth measure (column (2)) and the brokered deposit measure (column (4)) and it lowers risk by these measures.

The brokered deposit probits where the threshold is 5 percent and then 10 percent are not reported. However, for both of these thresholds the coefficient on the mutual variable remains negative and statistically significant. What differs is the significance of the other coefficients. With a 5 percent threshold, only size remains significant and positive. In the 10 percent threshold, none of the other variables are statistically significant.

One concern about the risk regressions is the possibility of selection bias. In our sample, of the 1,344 thrifts in existence at the end of 2001:Q4, 221 of them exited in the next five years. Furthermore, most of the exits were by stock thrifts. Of these exits, most were by acquisition, but a few failed or voluntarily liquidated.[30] Table 9 summarizes exit rates by organizational type.

With such a large exit rate, selection bias is a possibility. To investigate this, we ran a Heckman selection regression on the three measures of risk taking that are estimated with ordinary least squares. The variables we used for our exclusion restriction in the selection equation were $Earnings_{01}$, $Loan\text{-}to\text{-}Assets_{01}$, and $Cash\ and\ Due\ From_{01}$. We used these three variables because in the bank and credit union merger literature, they are associated with being acquired (Goddard, McKillip, and Wilson (2009) and Beccalli and Frantz (2013)). Low earnings suggest that management is performing poorly, which would make a thrift more appealing for takeover to improve efficiency. A low loan-to-assets ratio suggests that the thrift doesn't have good loan opportunities; so a takeover might provide more loan opportunities from the acquiring institution. Finally, high cash levels may suggest a lack of good investment options. While low

[30] We treated a thrift that converted to a commercial bank as not exiting.

earnings are associated with an increased chance of failure in our probit regression, low earnings do not necessarily mean that a thrift will choose to take more risk. Similarly, it is difficult to see a connection between the other two excluded variables and how much risk to choose. For these reasons, we think these are reasonable variables to exclude.

In the Heckman selection regressions for the *Chg in CLD* and *5-Year Asset Growth,* we found that the coefficient on the inverse Mills variable was insignificant, which suggests that selection bias is not a factor for our estimation on these two risk measures. In the natural log of *5-Year Z score* regression, however, we did find selection bias and, furthermore, it made the mutual variable insignificant in the risk regression, although it didn't change the sign or significance on the OTS dummy. Table 10a reports this result. While this one regression finds no connection between mutuals and risk taking, the other three do; so we think the totality of the results suggests that the mutuals take less risk.

Table 10b reports the results for the survival probit used in the Heckman selection estimation. Here, the statistically significant predictors of a thrift surviving until 2006 are low house price growth, mutual, OTS supervised, and high earnings. The significance of the mutual variable isn't surprising given our earlier discussion of the lack of a takeover market for mutuals as well as managerial incentives. Higher earnings suggest that the thrift is better run; so there is less pressure to sell to an outside institution. We are unaware of an obvious story for the OTS finding.

6.1 Other Evidence of Risk Taking

While *CLD Lending* is highly predictive of failure, it is a relatively small percentage of assets. The median *CLD Lending* share for the entire sample is only 3.6 percent and 11.5 percent for failed thrifts. While this exceeds median capital, a thrift with CLD defaults will still collect something on these assets, plus they will probably collect income on the loan for a while. To investigate the idea that *CLD Lending* is signaling something about a general taste for risk taking and riskier lending, we regress *CLD Lending* on performance of 1-*4 Family Real Estate Loans* using our housing bust sample. Recall that in our housing bust probit model, reported in Table 3, residential lending was not predictive of failure. Our idea is that a bank that is taking risk by concentrating in CLD lending might also be making lower-quality residential mortgage loans.

One challenge with specifying non-performing loan ratios is choosing the right point in time to measure this dependent variable because the ratio varies over time, and in some periods, we don't have an observation because the thrift had failed. We deal with this timing issue by simply taking the highest non-performing loan ratio for residential loans for a thrift over the 2007-13 period. We include controls for size and economic shocks. Table 11 reports the regression results. Here, we find that when we control for local economic shocks, our CLD measures are positively associated with worse residential lending performance. When we add $Mutual_{06}$ to the regression, the coefficient on this variable is negative. $Mutual_{06}$ remains significant when we add OTS_{06}.

We also tried an interaction term between the mutual and OTS dummies. The excluded class of thrifts is non-OTS supervised stock thrifts. The insignificant coefficient on $Mutual_{06}$ means that non-OTS mutuals are not significantly different from non-OTS stock thrifts. However, comparing OTS mutuals with OTS stock thrifts, we do find a statistically significant lower non-performing loan rate for the OTS mutuals. The size of this comparison is reported in the row $Mutual_{06}$+ $Mutual_{06}$*OTS_{06}. The other two comparisons, between OTS and non-OTS mutuals (reported in the row OTS_{06}+ $Mutual_{06}$*OTS_{06}) and between OTS and non-OTS stock thrifts (the coefficient on OTS_{06}) were not statistically significant.

Overall, these regressions provide evidence that thrifts that chose to take risk by concentrating in CLD lending also made lower-quality residential mortgages; so they took risk on at least one other dimension. Furthermore, the regressions find that mutuals originated higher-quality mortgages, as suggested by the negative coefficient on $Mutual_{06}$, which is further evidence of mutuals taking less risk.

7. Mutual Capital Behavior

A cost to being a mutual is an inability to raise capital except through retained earnings or by converting to stock owned.[31] However, the Competitive Equality Banking Act of 1987 authorized the creation of mutual holding companies (MHC) (Carow, Cox, and Roden (2009)).

[31] Mutual thrifts can also raise capital with mutual capital certificates or pledged deposits. For various reasons, such as the certificates not counting as Tier 1 regulatory capital, these two methods are rarely used (Office of the Comptroller of the Currency (2014)).

While most MHCs do not do this, an MHC is allowed to issue a minority share of equity in the underlying thrift while retaining a majority interest and retaining its mutual structure.

The usual corporate structure used to issue outside stock is called a two-tier mutual holding company. The mutual thrift is converted to stock that is 100 percent owned by an intermediate holding company. A minority share of the intermediate holding company can be sold to outsiders who can publicly trade the shares, while the MHC owns the majority share in the intermediate holding company. The thrift's depositors own the MHC, just as they owned the thrift before the conversion. They elect the directors of the MHC, who in turn control the intermediate holding company and thus the thrift proper.

This structure not only allows a thrift held by an MHC to raise external capital, it also allows an MHC to purchase and hold another financial institution (Luse (2005)). Sometimes the MHC is created as the first step toward a full conversion to being stock owned. One issue with this structure is the payment of dividends. Typically, when the intermediate holding company pays dividends, the MHC will waive its right to the dividend. This waiver makes it easier to pay out dividends to the outside investors and thus raise external capital. However, it creates the possibility of the thrift's earnings being paid out rather than being retained for the benefit of present and future depositors. Carow, Cox, and Roden (2009) document that dividend payout rates changed as the rule the OTS required MHCs to use in accounting for waived dividends changed.

This decision of whether to pay out dividends or retain earnings is one faced by any stock thrift or bank and illustrates how this hybrid mutual-stock structure can push a mutual closer to the incentives of a stock thrift. Another force that moves the hybrid MHC in this direction is the possibility of paying management with the equity. Doing this can help align management's incentives with those of stockholders, with all the attendant implications for risk-shifting incentives that we discussed earlier.

To analyze whether these hybrid mutuals behave differently than other mutuals, we consider our housing bust sample. In that sample, there are 67 MHCs that had issued stock at the end of 2006. Table 2e reports summary data for them. Compared with the full mutual sample, the median thrift held by an MHC with outside equity is larger, has lower capital, has a higher CLD concentration, and grew faster. Compared with stock thrifts, the median thrift held by an MHCs

with outside equity is slightly larger, but has more capital, has a lower CLD concentration, and didn't grow as fast.

At the end of 2006, we identified 67 hybrid mutuals in our sample. Of these, only one failed over the 2007-13 period. We run the probit on the mutual subsample with a dummy variable for the hybrid mutuals. Given their low failure rate, not surprisingly, we find that the dummy variable is insignificant and there is no substantial effect on the coefficients of the other variables.

8. Conclusion

Our paper contributes to the literature on the corporate governance of thrifts that started in the 1960s and developed during the savings and loan crisis of the 1980s. We found that mutual thrifts failed at a lower rate than stock thrifts during the 2007-13 housing bust. We also found that most of our regression results are consistent with the idea that mutuals take less risk than stock thrifts. Our results complement those of Cordell, Mac Donald, and Wohar (1993) and Esty (1997), who found that risk taking increases in thrift institutions after they convert from mutual to stock ownership.

Despite the high failure rate of OTS supervised thrifts, we found that once we controlled for other thrift characteristics and local economic conditions, OTS supervised thrifts did not fail at a statistically higher rate. Furthermore, we found that for two of our risk measures OTS supervised thrifts increased their risk less than non-OTS supervised thrifts during the housing boom.

Finally, as Table 1 reports, failure rates were much higher for thrifts with savings bank charters than other types of charters. The difference is surprising given the small differences in powers between the three charters. Our preliminary investigations did not find a statistical explanation for this difference, although we plan to continue to investigate this difference.

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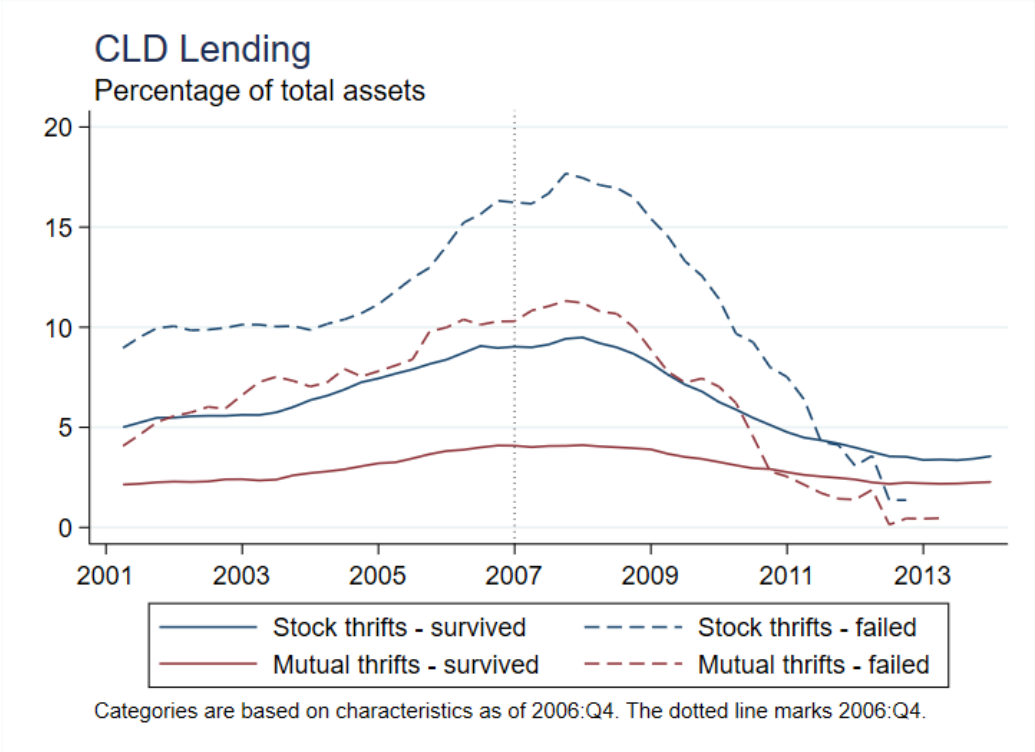
Figure 1 – CLD Lending by Ownership Type and Failure



Construction and land development (CLD) loan concentrations over 2001–13 for thrifts in our housing bust sample broken up by organizational form and whether they failed over the 2007-13 period. Mutual status for a thrift is as of 2006:Q4. The lines are averages of thrifts within each group.

Table 1 – Surviving and Failed Thrifts by Ownership, Charter, and Supervisor

	Mutual	Stock	S&L	Savings Bank	Co-op Bank	OTS	Non-OTS	All
Survived	726	369	281	746	68	682	413	1095
Failed	17	48	5	59	1	53	12	65
Total	743	417	286	805	69	735	425	1160

Number of thrifts from our housing bust sample by ownership, charter, and supervisor in 2006 and numbers of those that failed over the 2007-13 period. A thrift taken over by another depository institution that failed over the 2007-13 period is treated as failed. One taken over by another depository institution without FDIC assistance that survived is counted as survived.

Table 2a - Summary Statistics for the Housing Bust Sample (Q4:2006 Values)

	N	Mean	SD	Min	p25	p50	p75	Max
Size$_{06}$	1160	12.184	1.287	7.941	11.327	12.129	12.987	16.045
Capital$_{06}$	1160	0.121	0.051	0.045	0.087	0.106	0.142	0.480
Earnings$_{06}$	1160	0.005	0.010	-0.182	0.003	0.005	0.008	0.113
Uninsured Deposits	1160	0.113	0.091	0.000	0.054	0.092	0.147	0.734
1-4 Family Real Estate Loans	1160	0.441	0.181	0.002	0.312	0.442	0.569	0.953
CLD Loans	1160	0.062	0.078	0.000	0.011	0.036	0.081	0.596
Other Real Estate Loans	1160	0.130	0.115	0.000	0.049	0.108	0.182	0.853
Loan Loss Reserves	1160	0.006	0.004	0.000	0.003	0.005	0.007	0.050
Nonperforming Assets	1160	0.016	0.019	0.000	0.005	0.011	0.022	0.307
Interest Receivable	1160	0.005	0.002	0.000	0.004	0.005	0.006	0.020
3-Year Asset Growth	1160	0.215	0.405	-0.746	0.013	0.129	0.291	4.870
Peak to Trough	1160	0.155	0.087	0.002	0.094	0.140	0.218	0.553
Unemployment Increase	1160	5.072	1.279	1.133	4.000	4.867	6.067	9.700

Size$_{06}$ is the natural log of total assets. *3-Year Asset Growth* is calculated as the change in total assets from 2003:Q4 to 2006:Q4 divided by total assets as of 2003:Q4. See text for an explanation of other variables. All other thrift-specific variables are normalized by total assets.

Table 2b - Summary Statistics for Failed Thrifts in the Housing Bust Sample (Q4:2006 Values)

	N	Mean	SD	Min	p25	p50	p75	Max
Size$_{06}$	65	12.600	1.602	9.029	11.778	12.566	13.766	16.045
Capital$_{06}$	65	0.097	0.042	0.050	0.076	0.089	0.104	0.342
Earnings$_{06}$	65	0.004	0.012	-0.053	0.000	0.005	0.011	0.033
Uninsured Deposits	65	0.151	0.135	0.000	0.059	0.110	0.222	0.611
1-4 Family Real Estate Loans	65	0.384	0.188	0.063	0.255	0.354	0.512	0.865
CLD Loans	65	0.147	0.137	0.000	0.044	0.115	0.232	0.596
Other Real Estate Loans	65	0.155	0.114	0.000	0.068	0.141	0.206	0.541
Loan Loss Reserves	65	0.007	0.004	0.001	0.004	0.006	0.009	0.024
Nonperforming Assets	65	0.024	0.023	0.000	0.006	0.018	0.034	0.108
Interest Receivable	65	0.006	0.002	0.003	0.005	0.005	0.006	0.020
3-Year Asset Growth	65	0.482	0.649	-0.458	0.100	0.300	0.677	3.434
Peak to Trough	65	0.228	0.138	0.025	0.104	0.218	0.399	0.458
Unemployment Increase	65	6.018	1.563	2.067	4.467	6.267	7.167	8.100

See notes to Table 2a.

Table 2c - Summary Statistics for Mutual Thrifts in the Housing Bust Sample (Q4:2006 Values)

	N	Mean	SD	Min	p25	p50	p75	Max
Size$_{06}$	743	11.983	1.235	7.941	11.140	12.038	12.847	15.982
Capital$_{06}$	743	0.130	0.052	0.049	0.094	0.114	0.153	0.480
Earnings$_{06}$	743	0.004	0.005	-0.052	0.003	0.005	0.007	0.017
Uninsured Deposits	743	0.092	0.065	0.000	0.047	0.077	0.123	0.429
1-4 Family Real Estate Loans	743	0.488	0.165	0.002	0.375	0.496	0.599	0.953
CLD Loans	743	0.042	0.053	0.000	0.008	0.026	0.057	0.519
Other Real Estate Loans	743	0.104	0.091	0.000	0.037	0.084	0.149	0.853
Loan Loss Reserves	743	0.005	0.004	0.000	0.003	0.004	0.007	0.050
Nonperforming Assets	743	0.015	0.017	0.000	0.004	0.010	0.020	0.108
Interest Receivable	743	0.005	0.002	0.000	0.004	0.005	0.005	0.020
3-Year Asset Growth	743	0.118	0.190	-0.411	-0.006	0.084	0.210	1.370
Peak to Trough	743	0.149	0.064	0.002	0.104	0.140	0.198	0.444
Unemployment Increase	743	4.903	1.116	1.133	4.000	4.767	5.833	8.100

See notes to Table 2a.

Table 2d - Summary Statistics for Stock Thrifts in the Housing Bust Sample (Q4:2006 Values)

	N	Mean	SD	Min	p25	p50	p75	Max
Size$_{06}$	417	12.542	1.302	9.672	11.657	12.369	13.449	16.045
Capital$_{06}$	417	0.105	0.044	0.045	0.080	0.092	0.118	0.455
Earnings$_{06}$	417	0.007	0.015	-0.182	0.004	0.008	0.011	0.113
Uninsured Deposits	417	0.151	0.116	0.000	0.071	0.119	0.201	0.734
1-4 Family Real Estate Loans	417	0.359	0.177	0.003	0.235	0.345	0.471	0.920
CLD Loans	417	0.098	0.100	0.000	0.022	0.065	0.145	0.596
Other Real Estate Loans	417	0.176	0.137	0.000	0.085	0.152	0.227	0.809
Loan Loss Reserves	417	0.007	0.003	0.000	0.004	0.006	0.008	0.024
Nonperforming Assets	417	0.018	0.022	0.000	0.007	0.013	0.024	0.307
Interest Receivable	417	0.005	0.002	0.000	0.004	0.005	0.006	0.018
3-Year Asset Growth	417	0.386	0.588	-0.746	0.078	0.246	0.485	4.870
Peak to Trough	417	0.165	0.117	0.002	0.073	0.130	0.218	0.553
Unemployment Increase	417	5.373	1.482	1.133	4.067	5.567	6.267	9.700

See notes to Table 2a.

Table 2e - Summary Statistics for Thrifts Held by MHCs with Outside Stock in the Housing Bust Sample (Q4:2006 Values)

	N	Mean	SD	Min	p25	p50	p75	Max
Size$_{06}$	67	12.792	1.073	11.225	11.802	12.644	13.537	15.923
Capital$_{06}$	67	0.127	0.050	0.064	0.093	0.106	0.160	0.311
Earnings$_{06}$	67	0.005	0.004	-0.008	0.003	0.005	0.007	0.016
Uninsured Deposits	67	0.107	0.074	0.000	0.059	0.091	0.135	0.410
1-4 Family Real Estate Loans	67	0.443	0.159	0.002	0.341	0.455	0.537	0.772
CLD Loans	67	0.047	0.055	0.000	0.010	0.032	0.064	0.340
Other Real Estate Loans	67	0.129	0.116	0.002	0.061	0.106	0.162	0.765
Loan Loss Reserves	67	0.004	0.002	0.001	0.003	0.004	0.006	0.010
Nonperforming Assets	67	0.012	0.012	0.000	0.004	0.008	0.017	0.061
Interest Receivable	67	0.005	0.001	0.001	0.004	0.005	0.005	0.007
3-Year Asset Growth	67	0.238	0.221	-0.136	0.080	0.214	0.355	0.900
Peak to Trough	67	0.157	0.075	0.025	0.094	0.140	0.221	0.399
Unemployment Increase	67	5.086	1.115	2.067	4.067	4.900	5.833	7.633

See notes to Table 2a.

Table 3 – Probit Regression Results for Housing Bust Sample

	Pooled	Pooled	Pooled	Pooled	Pooled
	(1) Failure	(2) Failure	(3) Failure	(4) Failure	(5) Failure
Size$_{06}$	0.0317	0.00292	-0.00226	0.00742	-0.0129
	(0.586)	(0.961)	(0.970)	(0.902)	(0.831)
Capital$_{06}$	-6.437***	-5.757***	-5.827***	-5.892***	-5.994***
	(0.001)	(0.004)	(0.002)	(0.003)	(0.003)
Earnings$_{06}$	-17.56***	-17.70***	-18.05***	-17.42***	-17.51***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Nonperforming Assets	7.972***	7.372**	7.242**	7.547**	7.527**
	(0.007)	(0.014)	(0.016)	(0.012)	(0.012)
Loan Loss Reserves	10.97	7.567	10.02	8.008	9.180
	(0.545)	(0.686)	(0.593)	(0.667)	(0.621)
Uninsured Deposits	-0.00413	-0.258	-0.480	-0.204	-0.222
	(0.995)	(0.708)	(0.498)	(0.767)	(0.748)
1-4 Family Real Estate Loans	0.0934	0.287	0.232	0.201	0.201
	(0.864)	(0.605)	(0.678)	(0.719)	(0.720)
CLD Loans	3.878***	3.647***	3.451***	3.589***	3.619***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Other Real Estate Loans	-0.0728	-0.158	-0.203	-0.200	-0.211
	(0.920)	(0.828)	(0.780)	(0.783)	(0.772)
Interest Receivable	89.57**	82.89**	82.26*	76.37*	76.83*
	(0.034)	(0.049)	(0.051)	(0.072)	(0.071)
Peak to Trough	2.055**	2.160**	2.102**	2.118**	2.170**
	(0.017)	(0.011)	(0.014)	(0.013)	(0.011)
Unemployment Increase	0.155**	0.124*	0.127*	0.118*	0.118*
	(0.020)	(0.065)	(0.062)	(0.079)	(0.082)
Mutual$_{06}$		-0.431***	-0.402**	-0.382**	-0.617**
		(0.009)	(0.017)	(0.027)	(0.039)
3-Year Asset Growth			0.175		
			(0.229)		
OTS$_{06}$				0.191	0.033
				(0.272)	(0.887)
Mutual$_{06}$**OTS*$_{06}$					0.331
					(0.334)
Constant	-3.459***	-2.778***	-2.706***	-2.870***	-2.815***
	(0.000)	(0.003)	(0.005)	(0.003)	(0.003)
Mutual$_{06}$*+ Mutual*$_{06}$**OTS*$_{06}$					-0.286
					(0.146)
OTS$_{06}$*+ Mutual*$_{06}$**OTS*$_{06}$					0.364
					(0.152)
Observations	1160	1160	1160	1160	1160
Pseudo R^2	0.238	0.252	0.254	0.254	0.256
AIC	407.7	402.9	403.5	403.6	404.7
BIC	473.4	473.6	479.3	479.5	485.6

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Failure over the 2007-13 period is regressed over thrift characteristics as of 2006:Q4 and the size of economic shocks over the 2007-13 period.

Table 4 – Number of Thrifts with High Concentrations of CLD Lending

	# above 20% CLD	# above 20% CLD that failed
Stock – OTS	55	16
Stock – Non-OTS	12	2
Mutual – OTS	3	1
Mutual – Non-OTS	11	1

Number of thrifts by charter type with construction and land development (CLD) concentration greater than 20 percent of assets and number of these that failed.

Table 5 – Marginal Analysis

Failure rate at means	2.47%
	Marginal increase in failure probability
Size$_{06}$	0.02%
Capital$_{06}$	2.25%
Earnings$_{06}$	1.17%
Nonperforming Assets	0.91%
Loan Loss Reserves	0.16%
Uninsured Deposits	0.14%
1-4 Family Real Estate Loans	0.32%
CLD Loans	2.18%
Other Real Estate Loans	0.11%
Interest Receivable	0.95%
Peak to Trough	1.31%
Unemployment Increase	1.08%
Mutual$_{06}$	2.09%

Using the specification in Table 3, column (2), this table shows the change in the failure rate from a one standard deviation change in each variable from its mean in the direction that increases the failure rate. For example, because the coefficient on *CLD Loans* is positive in Table 3, the one standard deviation change increases this variable. In contrast, the coefficient on capital is negative; so a one standard deviation change decreases this variable. For the *Mutual*$_{06}$ dummy variable, we compare the mean value, which is 0.64, with the change from setting it to 0.00, that is, as if all mutuals were stock.

Table 6 – Housing Bust Subsample Probit Regression Results

	Pooled Failure	Mutual Failure	Stock Failure	Stock Failure
Size$_{06}$	(+)	(-)	(+)	(+)
Capital	(-)***	(-)	(-)**	(-)**
Earnings$_{06}$	(-)***	(-)***	(-)**	(-)**
Nonperforming Assets	(+)**	(+)	(+)	(+)
Loan Loss Reserves	(+)	(-)**	(+)	(+)
Uninsured Deposits	(-)	(-)	(-)	(-)
1-4 Family Real Estate Loans	(+)	(+)	(+)	(+)
CLD Loans	(+)***	(+)***	(+)***	(+)***
Other Real Estate Loans	(-)	(+)	(-)	(-)
Interest Receivable	(+)**	(+)***	(-)	(-)
Peak to Trough	(+)**	(+)**	(+)*	(+)*
Unemployment Increase	(+)*	(+)	(+)	(+)
Mutual$_{06}$	(-)***			
OTS$_{06}$				(+)
Observations	1160	743	417	417
Pseudo R-squared	0.252	0.357	0.171	0.172

Sign of the estimated coefficients in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Results reported in the Pooled Failure column correspond to the results reported in column (2) of Table 3.

Table 7 – Summary Statistics for Housing Boom Sample (2001-06)

	N	Mean	SD	Min	p25	p50	p75	Max
Size$_{01}$	1344	11.974	1.243	8.048	11.148	11.935	12.747	15.706
Capital$_{01}$	1344	0.109	0.041	0.039	0.080	0.098	0.127	0.357
Earnings$_{01}$	1344	0.007	0.007	-0.077	0.004	0.007	0.009	0.061
Cash and Due From$_{01}$	1344	0.072	0.063	0.002	0.028	0.050	0.095	0.420
Loan-to-Assets$_{01}$	1344	0.679	0.150	0.074	0.595	0.700	0.788	0.975
HPI Growth$_{01\text{-}06}$	1344	0.442	0.242	0.118	0.277	0.444	0.542	1.088
Chg in CLD	1123	0.026	0.049	-0.299	0.000	0.012	0.039	0.352
Average Brokered Deposits	1123	0.011	0.038	0.000	0.000	0.000	0.003	0.497
5-Year Z-score	1123	186.092	130.145	8.022	95.334	157.748	248.801	1148.557
Ln (5-Year Z-score)	1123	4.966	0.787	2.082	4.557	5.061	5.517	7.046
5-Year Asset Growth (dec. points)	1123	0.383	0.487	-0.687	0.074	0.272	0.572	2.484

Values of 5-Year Asset Growth above the 99th percentile are winsorized.

The first five variables are values as of 2001:Q4. The 5-Year Asset Growth is calculated over the 2001:Q4 to 2006:Q4 period. The 5-Year Z-score and Average Brokered Deposits variables are calculated using 20 quarterly observations from 2002:Q1 through 2006:Q4. Because a sizable fraction of thrifts exited over this period, there are fewer observations for these variables.

Table 8 –Risk Measure Regressions on Housing Boom Sample

	(1) Chg in CLD share of assets (decimal points)	(2) 5-Year Asset Growth	(3) Ln (5-Year Z-score)	(4) Brokered Deposits Usage
$Size_{01}$	0.00322**	0.0260*	0.127***	0.214***
	(0.017)	(0.087)	(0.000)	(0.000)
$Capital_{01}$	-0.0569*	-1.421***	4.714***	-4.158***
	(0.061)	(0.000)	(0.000)	(0.000)
$HPI\ Growth_{01\text{-}06}$	0.00911	0.480***	0.0720	-0.0687
	(0.256)	(0.000)	(0.462)	(0.695)
$Mutual_{01}$	-0.0179***	-0.189***	0.484***	-0.862***
	(0.000)	(0.000)	(0.000)	(0.000)
OTS_{01}	-0.000351	-0.0685**	0.00644	-0.290***
	(0.911)	(0.017)	(0.886)	(0.001)
Constant	0.00288	0.192	2.569***	-1.754***
	(0.878)	(0.347)	(0.000)	(0.000)
Observations	1123	1123	1123	1123
R^2	0.050	0.136	0.184	
Pseudo R-squared				0.161
AIC	-3613.9	1416.9	2433.0	1257.9
BIC	-3583.8	1447.0	2463.1	1288.0

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$
Columns (1)-(3) report results for ordinary least squares regressions estimated using robust standard errors. Column (4) reports the results of a probit regression where the dependent variable, *Brokered Deposits Usage* is a dummy variable equal to 1 if the average ratio of brokered deposits to total assets over the quarters from 2002:Q1 to 2006:Q4 is greater than zero. A total of 386 thrifts had an average greater than zero. We tried alternative definitions for the dummy variable by setting the average brokered deposits threshold at 5 percent and 10 percent of total assets, capturing 66 and 31 thrifts, respectively. Those results are discussed in the text.

Table 9 – Exit Rates by Ownership Type in Housing Boom Sample

	# of thrifts	# of exited thrifts	# of mergers	# of failures	# of liquidations	Share that exited
Mutual	806	35	31	3	1	4.3%
Stock	538	186	182	1	3	34.6%

Number of thrifts in our 2001:Q4 sample and the number that exited and how they exited over the 2001:Q4-2006:Q4 period. A thrift that converted to a commercial bank over this period is treated as not exiting.

Table 10a – Heckman Selection Outcome Regression on ln(5-Year Z-Score)

	Ln (5-Year Z-score)
Size$_{01}$	0.119***
	(0.000)
Capital$_{01}$	4.813***
	(0.000)
HPI Growth$_{01\text{-}06}$	0.186*
	(0.092)
Mutual$_{01}$	0.110
	(0.485)
OTS$_{01}$	-0.0386
	(0.478)
Constant	3.066***
	(0.000)
Lambda	-0.782**
	(0.011)
Observations	1344

p-values in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Lambda is the inverse Mills ratio calculated from the probit selection equation reported in Table 10b.

Table 10b – Probit Regression on Survival During the Housing Boom (2001-06)

	Survived
Size$_{01}$	-0.0278
	(0.516)
Capital$_{01}$	-1.144
	(0.388)
HPI Growth$_{01\text{-}06}$	-0.387**
	(0.032)
Mutual$_{01}$	1.471***
	(0.000)
OTS$_{01}$	0.248**
	(0.017)
Earnings$_{01}$	20.61***
	(0.002)
Cash and Due From$_{01}$	-0.863
	(0.282)
Loan-to-Assets$_{01}$	0.472
	(0.151)
Constant	0.405
	(0.535)
Observations	1344
Pseudo R-squared	0.206
AIC	971.6
BIC	1018.5

Table 11 – Nonperforming 1-4 Family Regression Results

	(1) Ln(*Max Family Nonperforming*)	(2) Ln(*Max Family Nonperforming*)	(3) Ln(*Max Family Nonperforming*)	(4) Ln(*Max Family Nonperforming*)
$Size_{06}$	-0.119***	-0.129***	-0.126***	-0.128***
	(0.000)	(0.000)	(0.000)	(0.000)
CLD Lending	4.520***	4.219***	4.211***	4.178***
	(0.000)	(0.000)	(0.000)	(0.000)
Peak to Trough	0.227	0.313	0.332	0.258
	(0.604)	(0.474)	(0.451)	(0.560)
Unemployment Increase	0.134***	0.122***	0.119***	0.122***
	(0.000)	(0.000)	(0.000)	(0.000)
$Mutual_{06}$		-0.164**	-0.154**	-0.009
		(0.026)	(0.044)	(0.951)
OTS_{06}			0.0465	0.194
			(0.495)	(0.186)
$Mutual_{06}*OTS_{06}$				-0.207
				(0.197)
Constant	1.655***	1.944***	1.890***	1.806***
	(0.000)	(0.000)	(0.000)	(0.000)
$Mutual_{06}+ Mutual_{06}*OTS_{06}$				-0.216**
				(0.010)
$OTS_{06}+ Mutual_{06}*OTS_{06}$				-0.014
				(0.851)
Observations	1152	1152	1152	1152
R^2	0.135	0.140	0.140	0.142

p-values in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Regression of thrift characteristics in 2006:Q4 on performance of residential lending over the 2007-13 period. See text for the definition of *Max Family Nonperforming. Max Family Nonperforming* was winsorized at the 1.5 and 98.5 percentiles. These results are estimated using robust standard errors. Eight thrifts included in the 2006:Q4 housing bust sample were excluded from these regressions because they were acquired during the first quarter of 2007 and therefore did not file a TFR or Call Report during the 2007-13 period. Consequently, we could not calculate the *Max Family Nonperforming* variable for these eight thrifts.