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Banking market structure and financial stability: Evidence from the Texas real estate crisis in the 1980s ☆

Jie Gan*

Department of Finance, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China

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Abstract

This paper examines the relationship between banking market structure and financial stability. Using data on thrifts, a type of banking institution specializing in residential mortgage lending, I test two related hypotheses. First, competition reduces franchise value. Second, reduced franchise value induces risk taking. Testing the second hypothesis exploits predictions that when hit by an exogenous shock, the slope of risk with respect to franchise value becomes more negative because thrifts adopt "bang-bang" strategies and choose minimal or maximal risk. Using the Texas real estate collapse in the 1980s as a natural experiment, I find evidence supporting both hypotheses.

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*Tel.: +852-2358-7665; fax: +852-2358-1749.
E-mail address: jgan@ust.hk (J. Gan).

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1. Introduction

Casual observation suggests that recent financial crises, such as the thrift crisis in the United States and the financial crisis in Southeast Asia, were preceded by waves of financial liberalization that promoted competition. Hellmann et al. (2000) and Allen and Gale (2000) explicitly model how competition, as a result of financial liberalization, can induce banks to bid up deposit rates and reduce franchise value (the discounted stream of future profits). Declining franchise value, combined with a deposit insurance guarantee, accentuates risk-shifting incentives. The resulting moral hazard and risk taking, in turn, can lead to financial instability. Besanko and Thakor (1993) model the impact of competition on the asset side (i.e., the value of relationship banking) and reach a similar conclusion. However, no empirical evidence shows a direct link between banking market structure (i.e., competition) and financial instability.[1]

This paper empirically investigates the interactions among market structure, franchise value, and bank risk by examining a particular type of banking institution that specializes in residential mortgage lending, i.e., savings and loans or thrifts. Specifically, the paper tests two hypotheses. First, competition reduces franchise value. Second, declining franchise value, combined with government deposit insurance guarantees, leads to increased risk taking. Although no previous study has examined both hypotheses, several papers have studied the second one, contributing to an understanding of bank risk taking (e.g., Keeley, 1990; Saunders and Wilson, 1996; Gorton and Rosen, 1995). As discussed later, the results are mixed and suggest a number of methodological difficulties, such as measurement error and omitted variables, in testing for such a relation.

I use the Texas real estate collapse in the 1980s and its impact on the thrift industry as a natural experiment to test these hypotheses. Franchise value comes from two sources: rents on assets-in-place and future investment opportunities. Several authors (e.g., Marcus, 1984; Marshall and Venkataraman, 1999; Gan, 2003) show that when banks do not earn rents on assets-in-place, they adopt "bang-bang" strategies: banks with many positive net present value (NPV) investment opportunities adopt the safe strategies to get out of trouble, while those with few

[1] Studies using international data provide some indirect evidence. Demirgus-Kunt and Detragiache (1998) find that financial liberalization is associated with lower bank profits. However, in their study of bank regulations in different countries, Barth et al. (2000) do not find a strong link between concentration in a banking system and the likelihood of suffering a banking crisis. Following Keeley (1990), there are several studies on the relation between franchise value and risk taking. But as is shown in detail below, they have achieved only limited success.

positive-NPV investment opportunities go to the opposite extreme and gamble for resurrection. A direct implication is that, if banks are hit by an exogenous shock that wipes out their current profits, they tend to choose either the minimal or the maximal feasible risk. The slope of bank risk with respect to franchise value thus becomes more negative. This result provides a unique way to identify the impact of franchise value on risk taking: it can be transformed into testing for a steeper (more negative) slope. Focusing on differences instead of levels is more robust to endogeneity issues, because even if the slope estimates are biased, the difference in the estimates is unbiased to the extent that the biases are of similar magnitude before and after a shock.

The prediction about bank behavior when struck by exogenous shocks applies well to Texas thrifts during the real estate crisis of the 1980s. During this time, falling oil prices and new federal tax laws dramatically reduced the demand for real estate, resulting in a collapse in both the commercial and residential real estate markets. This collapse seriously hurt Texas thrifts, whose main business is in residential mortgage lending. It essentially eliminated the thrifts' rents on assets-in-place and induced them to adopt "bang-bang" strategies. Moreover, compared with commercial banks, the thrift industry has several industry characteristics, including fewer repeated transactions in mortgage lending, higher insider ownership, and more clearly defined local markets. These industry characteristics, as is discussed later, provide additional advantages that increase the statistical power of the tests and mitigate potential omitted-variable problems.

This paper presents evidence supporting the theoretical predictions. I show that market concentration is positively related to franchise value. When the Texas real estate market collapsed, thrifts adopted "bang-bang" strategies, and the propensity of thrifts to increase risk was negatively related to franchise value. Moreover, the slope of risk with respect to franchise value became more negative during the shock. Taken together, the evidence suggests that a concentrated market structure preserves franchise value and increases financial stability.

The remainder of this paper is organized in four sections. Section 2 lays out the empirical strategy. Section 3 describes the sample and defines important variables. Section 4 reports the main empirical results. Finally, Section 5 summarizes and concludes the paper.

2. Empirical strategy

The flow chart below illustrates the two hypotheses tested in this paper. First, a more competitive market structure reduces franchise value. Second, declining franchise value, combined with a government deposit insurance guarantee, accentuates risk-shifting incentives and leads to increased risk taking.

$$\text{Market} \underbrace{\text{structure} \rightarrow \text{Franchise}}_{\text{Hypothesis 1}} \underbrace{\text{value} \rightarrow \text{Risk taking}}_{\text{Hypothesis 2}}.$$

2.1. Previous studies on the link between franchise value and risk taking

Several studies have evaluated the second hypothesis. The results, however, are not conclusive. Keeley (1990) and Demsetz et al. (1996) find a negative impact of franchise value on risk choices. Galloway et al. (1997) and Saunders and Wilson (1996) find that the results are sensitive to the sample periods. Gorton and Rosen (1995) find that the risk choices of well-capitalized banks are not consistent with the franchise-value explanation.

These inconsistencies suggest several difficulties in testing for a relationship between franchise value and risk taking. The first is a measurement-error problem arising from using Tobin's Q (defined as the market-to-book-asset ratio) as the proxy for franchise value. In addition to the usual criticism that the average Q differs from the theoretical marginal Q, Tobin's Q is particularly problematic in a banking setting. As in Gan (2003), the total market value of assets (MV) can be decomposed as

$$MV = A + G + P = BV + \underbrace{R + G}_{\text{Franchise value}} + P, \tag{1}$$

where A is the assets-in-place; G is the growth opportunities, which can be thought of as rents captured from either expansion of existing assets or acquisition of new productive assets; and P is the government deposit insurance guarantee, which, as first pointed out by Merton (1977), resembles a put option. The value of the assets-in-place can be further decomposed into the book value (BV) and the rents on the assets-in-place (R). The sum of the rents on the assets-in-place (R) and future rents (G) is the franchise value. A higher Q can come from both franchise value ($R + G$) and the government guarantee (P), thus creating measurement errors. The instrumental-variable (IV) method, a usual solution to measurement-error problems, requires that the proxy variable not be correlated with the measurement error. As the franchise value is generally negatively related to the put option value, the IV method does not correct for this measurement-error problem.

The second difficulty relates to the use of ex post risk measures that do not necessarily reflect banks' voluntary choices. For example, managers have only limited control over nonperforming loans and over stock-return volatilities, two popular risk measures. Nonperforming loans reduce earnings and valuations and thus lower Q. Therefore, an observed relationship between risk, as measured by nonperforming loans, and franchise value, as measured by Q, could be hard-wired. On the other hand, it is well documented that volatilities tend to increase with low returns, the so-called asymmetric volatility (e.g., French et al., 1987; Wu, 2001). As low returns are also associated with low market value and thus Q, a negative relation between Q and risk, as measured by the return volatility, may not reflect the effect of franchise value.

The third difficulty relates to sources of market power. Bank market power potentially comes from two sources: the spatial distribution of banks, which reflects how far competing banks are from one another, and the lock-in effect, which arises from the private information acquired during the lending relationships. Petersen and

Rajan (1995) show that banks are more likely to finance young and low-quality firms when the credit market is concentrated because market concentration and thus market power allow them to extract monopoly rents when the firms become older. Therefore, lock-in effects tend to reduce the statistical power of the tests. However, it is worth noting that recent work by Ongena and Smith (2001) suggests that low switching costs permit firms to terminate lending relationships and therefore the magnitude of rents from lock-in effects may not be empirically significant.

Lastly, one needs to control for the potential conflicts of interest between shareholders and managers. Conflicts of interest could affect risk taking in two ways. On the one hand, managers may be risk averse (for evidence in banking, see Saunders et al., 1990; Esty, 1993). On the other hand, as pointed by Gorton and Rosen (1995), bad managers may take on excessive risks in an attempt to convince shareholders that they are good managers, especially when the industry is unhealthy. Therefore, failing to control for inside ownership could lead to biased estimates. However, insider ownership data are not generally available for individual banks and thrifts.

2.2. *Identification through an exogenous shock*

Several studies show that when banks do not earn rents on assets-in-place [i.e., $R = 0$ in Eq. (1)], they adopt "bang-bang" strategies: depending on their future investment opportunities, they optimally choose either the minimal or the maximal feasible risk (e.g., Marcus, 1984; Suarez, 1994; Marshall and Venkataraman, 1999; Gan, 2003). The appendix provides a simple model demonstrating this result. Although the "bang-bang" theory predicts binary risk choices, it may not be feasible for all thrifts to choose the actual maximal or minimal risk. During a given timeperiod, how much thrifts can actually change their risk levels depends on both incentives and ability. The ability to change risk is constrained by how liquid the assets are or how quickly the thrift can raise more investable funds. Under the simplistic assumption of a constant ability to increase risk across thrifts, the slope of risk levels with respect to franchise value should become steeper and more negative (as illustrated in Fig. 1). In fact, this is a sufficient but not necessary condition. All I need to assume is that, among thrifts that choose to decrease (increase) risk, the relatively high (low) franchise-value thrifts do not have so much less ability to change risk that the lack of ability offsets their stronger incentives to increase risk.

This result is very useful because identifying the relationship between franchise value and risk can be achieved by testing whether the relationship becomes more negative after the shock. Testing for differences in slopes mitigates endogeneity problems, because, even if the slope estimates are biased, the difference in slope coefficients is still unbiased as long as the biases are of similar magnitude before and after the shock. Within this framework, I test the following two sets of hypotheses.

Hypothesis 1. Market concentration leads to higher franchise value.

Hypothesis 2. Higher franchise value reduces risk taking. I test this hypothesis through three subhypotheses. The first two test for the existence of "bang-bang"

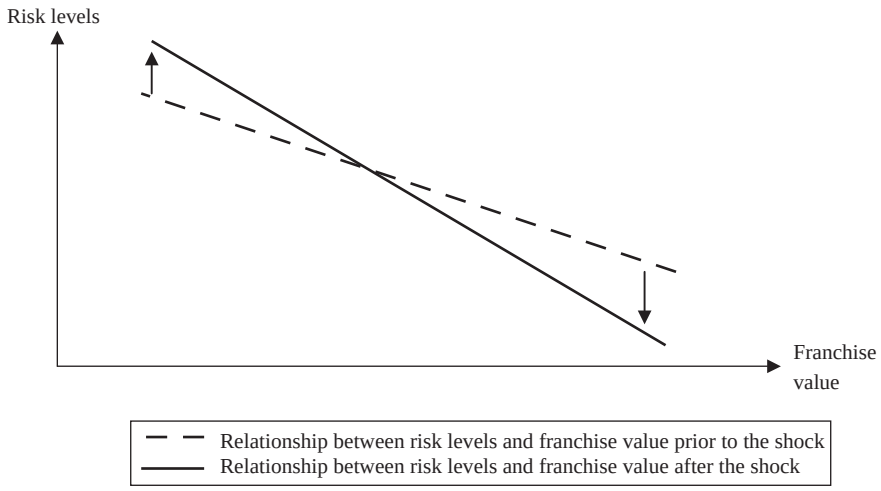

Fig. 1. The relationship between risk levels and franchise value when banks adopt "bang-bang" strategies. The dashed line represents the relationship between risk levels and franchise value prior to a shock; the solid line shows the relationship after a shock. The theory predicts that, when hit by an exogenous shock that wipes out the rents on current assets, banks adopt "bang-bang" strategies. That is, banks with low fracnchise value tend to take extremely high risk (the upward-pointing arrow), whereas banks with high franchise value tend to reduce their risk levels (the downward-pointing arrow). As a result, the slope of risk levels with respect to franchise value becomes more negative after a shock.

strategies. The third one tests for the change in the slope of risk with respect to franchise value.

Hypothesis 2a. The distribution of asset risk becomes more dispersed after the shock.

Hypothesis 2b. The propensity to increase risk is negatively related to franchise value.

Hypothesis 2c. The relationship between risk and franchise value becomes more negative during the shock.

I test the hypotheses with two-stage regressions. In the first stage, a predicted value for franchise value serves as an input to the second stage. The two-stage procedure not only addresses the potential endogeneity problem resulting from measurement errors in franchise value, but it also captures how market concentration discourages risk taking by relating market concentration to franchise value, which in turn is linked to risk taking.

An implicit assumption in this analysis is that market structure is exogenously determined. Although this is a common assumption in the literature, if positive shocks to profits attract entries, market structure can be endogenous, resulting in biased and inconsistent coefficient estimates. As market concentration and the error

term are negatively correlated, the direction of the bias, however, tends to reduce (the absolute value of) the coefficient estimate of the concentration variable. Therefore, although correlations among independent variables could complicate the analysis, the endogeneity of market structure does not intuitively seem to be a serious concern.[2]

2.3. Texas real estate crisis as a natural experiment

The economy in Texas is highly dependent on oil. As reported by Horvitz (1990), the oil-mining sector represented over 15% of the state's real gross product in 1980. Ad valorem oil and gas severance taxes alone made up 21% of the state's tax revenue in 1985. During the period of high oil prices in the 1970s and the early 1980s, the Texas economy enjoyed a rapid expansion. Accompanying this economic prosperity was a boom in real estate development, which was based largely upon the energy business (White, 1991). Oil prices, however, collapsed in July 1986, which hurt the Texas economy severely. There was a 44% decline in employment in the oil-mining sector and a 25% decline in total industrial employment in Texas. As pointed out by Dipasquale and Wheaton (1996), household income is an important determinant of the demand for housing and thus housing prices. The weak economy put downward pressure on housing prices. To make things worse, the Tax Reform Act of 1986 reduced tax incentives for holding real estate. In particular, it lowered depreciation allowances, limited the ability of investors to use losses from real estate to offset other taxable income, and raised the taxes on capital gains from asset sales.

As a consequence of the sharp decline in oil prices and the new federal tax policies, the commercial and residential real estate markets in Texas collapsed. As pointed out by White (1991), documenting declines in real estate value is not easy because price series and indices for real estate are not readily available, and those that are available are frequently flawed.[3] White (1991) claims that perhaps the only reliable price index is by the Frank Russell Company, which tracks the prices of high-quality commercial properties by region. In the Southwest region, a 30% drop occurred between 1985 and 1987 for office buildings. The data on the residential housing

[2] I examine the determinants of the market structure of thrifts in Texas. I find that the market structure is almost solely determined by population density, probably reflecting the regulators' chartering policies as this is a highly regulated industry. I also check if this finding affects the results in Section 4.1 on the determinants of franchise value, where the population density serves as an independent variable along with the market-structure variable. I do not find any collinearity problems, suggesting that once the market structure is established, it has its own independent influence on competitive behavior, whereas population density serves as a measure of market size. To conserve space, these results are not reported in this paper but are available upon request.

[3] They usually do not control for property types or quality (e.g., size, location, or attributes). They also suffer from a sample-selection bias because they are usually based on actual transaction prices. During a downturn, people typically hold on to their homes rather than sell at low prices. Many transactions would involve the more expensive homes by individuals least affected by the economy. The only price series at the state level for existing homes that I have found is from the National Association of Realtors. The median sales price of existing homes in Texas was $70 thousand at the end of 1985, declining to $65 thousand in February 1988, and then recovering to $70 thousand at the end of 1989.

permits in Texas may illustrate the magnitude of the shock to housing prices: the number of housing permits was only a quarter of its 1984 level at the end of 1987 (U.S. Census Bureau). Statistics from Houston are also telling. Housing prices in Houston at the end of 1987 were more than 30% below the level in 1984, an unprecedented decline in a major metropolitan area since the Great Depression of the 1930s (University of Houston Center for Public Policy).

2.3.1. Natural experiment

The Texas real estate crisis serves as a good setting to test the hypotheses. First, it provides an exogenous shock that allows me to identify the relationship between franchise value and risk. Second, the institutional features of the thrift industry further help alleviate the empirical difficulties discussed earlier.

The shock was severe and wiped out thrifts' current rents. The average profitability, measured as return on assets, fell from 0.22% in 1984 to −0.22% in 1986. The shock was also exogenous (it was caused by oil price drops and federal tax-law changes), creating a cleaner environment in which to assess thrift behavior. Moreover, according to Strunk and Case (1988), Texas state laws were among the most liberal in the nation in granting investment powers. Liberal laws allowed thrifts to take on as much risk as they wished, which increases the power of my tests.

Focusing on thrifts instead of commercial banks provides several additional advantages. First, because residential mortgage lending involves few repeated transactions, the market power of thrifts comes mainly from their spatial distribution, rather than from lock-in effects. This increases the statistical power of the tests because, as discussed earlier, the lock-in effect, if existed, makes it more difficult to find the predicted relationship. Second, conflicts of interest between shareholders and managers become less important in this setting, which mitigates the omitted-variable problem arising from the lack of data on inside ownship. With respect to managerial risk aversion, Esty (1993) reports that thrifts have significantly higher insider ownership than do commercial banks, which potentially results in more aligned interests. In principle, managers with large ownership shares are increasingly undiversified and, as reported by Tufano (1996), could engage in risk management to undo risk taking desired by shareholders. This, however, does not affect my tests much because the focus of this paper is on risk taking stemming from the moral hazard and because my measures of risk, namely, direct real estate investments and brokered deposits, reflect unmanaged risk. Moreover, empirical evidence from the thrift industry seems to suggest that either risk management is not widely practiced (Kane, 1989) or, for those that do engage in risk management, no significant difference exists in the hedging behavior among thrifts with different insider ownership (Schrand and Unal, 1998).[4] With respect to corporate control

[4] Kane (1989) reports that few thrifts held hedging positions. Schrand and Unal (1998) find that, for a sample of large publicly traded thrifts, the risk management behavior of thrifts with high inside ownership is not significantly different from those with low ownership after the mutual-to-stock conversion. They do find that thrifts with high inside ownership hedge more interest rate risk before the conversion, which the authors interpret as reflecting incentives for value maximization provided by ownership because interest rate risk tends to reduce total firm value.

considerations, when everyone is hurt by an exogenous shock, ex post performance becomes an unreliable indicator of managerial ability.[5] Thus, bad managers do not need to take excessive risks in an attempt to convince outsiders that they are good managers, which allows me to separate the effect of franchise value from that of corporate control. Lastly, mortgage lending has traditionally been a local business. For many years, thrifts' lending was limited to within 50 miles of their home offices. Although these restrictions were officially lifted in the 1980s, markets were, according to Gilbert (1984), generally confined to small local areas. Thus, the industry has more clearly defined local markets, which not only helps define market areas but also ensures that, because of a lack of contestability, market structure reflects competitive behavior.

3. Data

In this section, I first describe how I measure two important variables in the empirical analysis, namely, risk and franchise value. Then I describe the data and present the summary statistics.

3.1. Measuring risk

I employ two measures of risk. The first is direct investment in real estate as a percentage of assets (% Direct Real Estate Investment), which has been reported as an important way for Texas thrifts to gamble (e.g., Barth, 1991; Horvitz, 1990; White, 1991). The literature commonly adopts this variable as a measure of risk for thrifts (e.g., Barth et al., 1995; McKenzie et al., 1992; Knopf and Teall, 1996). This variable is reported separately from equity acquired in case of default in the Thrift Financial Reports database. Direct real estate investments are risky for several reasons. First, such investments are equity claims, which are junior to debt (loans). Second, and more important, they symbolize a willingness to invest in risky real estate development. Real estate loans are divided according to the phase of projects into land loans, construction or development loans, and permanent mortgage loans. The earlier in the project phase, the more uncertainty there is about future cash flows and, therefore, the riskier the loans. Crockett et al. (1985) report that the thrifts formed limited partnerships or joint ventures with local developers to develop commercial properties, in which they typically contributed only nominal funds, perhaps $1,000. They then underwrote land and development loans, which were much riskier than their traditional business of residential mortgage lending. Third, as Crockett et al. (1985) report, these land and development loans and equity contributions would not be paid off (both the principle and the interest) until the projects were completed; they were thus long-term claims. As thrifts were funded

[5] An analogy is using exams to evaluate students. When the exam is extremely difficult, everyone fails. Then it is difficult to distinguish the relatively good students from the bad ones.

with short-term variable rate deposits, this mismatch exacerbates the interest rate risk resulting from the mismatch of maturity between assets and liabilities. Lastly, direct real estate investments represent an ex ante measure of risk because managers should know at the time that they were taking considerable risk. Not surprisingly, based on ex post analyses of the failed thrifts, a number of studies (e.g., Barth et al., 1989; Benston and Brumbaugh, 1988) indicate that direct investments in real estate were strongly associated with failure and with resolution costs in the late 1980s (for a survey, see White, 1991).

The second risk measure is brokered deposits as a percentage of assets. Brokered deposits are deposits obtained through brokers who gather funds from individual investors across the country and place them in large bundles. Thrifts needed cash to invest and bid up interest rates. According to a February 16, 1989 *New York Times* report, even after the government announced its proposal to rescue the savings and loans industry in 1989, Texas thrifts paid as much as 150 basis points more for brokered deposits compared to the national average. Paying high rates means that the thrifts had to invest in high-yield and, therefore, high-risk assets to break even. Brokered deposits thus reflect the willingness of thrifts to take risk and indicate ex ante risk. In addition, the interest rates on brokered deposits are determined in the market. Thrifts with riskier assets have demand curves further out to the right compared with those with low risk because they are more willing to bid up the interest rates and obtain a larger quantity of deposits. Although I do not observe the actual interest rates being paid, the quantity of brokered deposits signals the rates and thus the riskiness of the assets. Therefore, this measure is also a market-based measure of risk. Finally, rates subject to competitive bidding left many thrifts in the position of having mismatched portfolios, worsening the interest rate risk. Several studies (e.g., Payne, 1987; Southern Finance Project, 1990) show that brokered deposits are associated with risky investments and probable failures.

Thrifts do have other sources of risk. For example, as they hold long-term fixed rate mortgages funded with short-term variable rate deposits, they are sensitive to rises in interest rates. Benston et al. (1991) and Benston and Carhill (1994) show that the thrift failures in the early 1980s when interest rates rose sharply were primarily rooted in interest rate risk arising from maturity mismatch. Detailed data on the maturity structure of thrifts' mortgage loans and liabilities are not available. However, this does not seem to create a problem for my tests because interest rates declined through the rest of 1980s. Barth (1991), Benston and Carhill (1994), Kane (1989), and White (1991) have pointed out that interest rate risk associated with the mismatch of maturities between mortgage loans and liabilities was no longer the main problem after 1983. Nevertheless, interest rate risk arising from sources other than long-term mortgage loans still matters. It is largely captured in the two risk measures described earlier.

Commercial and industrial loans (C&I loans) are often used as a risk measure for commercial banks (e.g., Gorton and Rosen, 1995; Demsetz et al., 1996). For thrifts, according to Benston (1985) and Barth et al. (1989), the percentage of C&I loans is not related to failure or increased resolution costs. C&I loans on average constitute a small percentage (3%) of the total assets of Texas thrifts and are not statistically

different from the national average.[6] Given, as reported by Barth (1991) and Strunk and Case (1988), that Texas thrifts held much riskier assets than other thrifts in the nation, this variable does not seem to capture the riskiness of Texas thrifts.

Lastly, junk bond investments are sometimes thought to be associated with risk taking (e.g., White, 1991). However, few Texas thrifts (from 13 to 18 thrifts between 1985 and 1989) invested in junk bonds. Therefore, junk bonds cannot be used as a risk measure.

3.2. Measuring franchise value

Franchise value is the discounted stream of current and future profits. Actual earnings, however, are affected by the real estate collapse. If franchise value is something intrinsic to a thrift, the profitability prior to the shock should be a proxy for franchise value resulting from serial correlation in earnings. I resolve concerns regarding measurement errors using an instrumental-variable (IV) specification. The first instrument is the natural log of the number of thrifts in a town.[7] Several theoretical studies have suggested a direct link between the number of banks and their competitive behavior (Besanko and Thakor, 1993; Matutes and Vives, 2000; Allen and Gale, 2000). The log-transformation captures the decreasing marginal impact of entry, which was identified by Bresnahan and Reiss (1991) in their study of the retail and professional service industries. In addition, thrifts can earn rents from their superior production efficiency or from the local business environment (e.g., borrower quality). Production efficiency is most likely captured by past earnings. Other instruments include local economic variables, such as personal income and income growth, to capture the quality of the average retail borrower and local demographic characteristics, such as population density and population growth, to capture market size.

3.3. The sample

The data mainly come from the Thrift Financial Reports database, which contain mandatory quarterly reports including balance sheets, income statements, and supplementary information for all federally insured thrifts. Data on brokered deposits are from the Federal Reserve Bank of Chicago. I obtain local demographic and economic data from *U.S. Counties*: *A Statistical Abstract Supplement*. I obtain

[6] Direct real estate investments also account for a small percentage (1%) of total assets. However, as discussed earlier, they are leveraged up and thus indicate a large position in risky real estate development projects. Moreover, Texas thrifts hold significantly more direct real estate investments than the national average.

[7] Branching and multi-thrift holding companies could affect my definition of market area. However, according to my communication with James R. Barth, the chief economist at the Federal Home Loan Bank Board in the late 1980s, there was relatively little branching by thrifts and there were very few multi-thrift holding companies during the 1980s. The Office of Thrift Supervision 2000 Fact Book indicates that there were only 13 multi-thrift holding companies with 19 thrifts in the United States in 1998. Earlier data on multi-thrifts do not exist.

data on the number of bank branches from *Market Guide Survey*, which covers only towns that have a newspaper.

The sample period starts in 1984, the first year for which the quarterly financial reports became available. These quarterly reports contain much more detailed financial information than had been previously reported. Following the relatively stable period of 1983–1984, oil prices started to decline in 1985 before turning into the 1986 crash. I choose 1987 as the last year of the crisis. My choice reflects a trade-off between using a longer time period to allow for the full effect of the shock and excluding other events that might also have affected the thrifts' behaviors. In February 1988, the Federal Home Loan Bank Board (FHLBB) launched the Southwest Plan and merged ailing institutions with healthy ones. In these assisted mergers, FHLBB often provided paper capital to the post-merger entities, which allowed them to operate at very low capital ratios (Horvitz, 1990). The total number of Texas thrifts declined from 279 at the end of 1987 to 197 at the end of 1989. To the extent that it took longer for some thrifts to change their risk levels in response to the shock, my choice of the crisis period is conservative and makes it more difficult to discern the predicted relationships.

Panel A of Table 1 displays the summary statistics in 1984 unless otherwise specified. In their study of bank competition, Petersen and Rajan (1995) point out that structural differences could exist between banks in urban and rural areas. Therefore, I report the summary statistics for urban and rural thrifts separately. Urban and rural areas are defined according to whether they belong to a Metropolitan Statistical Area (MSA). Overall, urban and rural thrifts are similar except for the two risk measures in 1987 and asset size. In 1984, direct real estate investment was 1.0% for Texas urban thrifts and 0.9% for rural thrifts and the difference was not statistically significant. In 1987, it increased to 2.7% among urban thrifts and remained the same among rural thrifts. Although the difference in means is not statistically significant, the difference in medians is significant (5% level). As noted earlier, a small percentage of direct investment is leveraged up to become a large position in risky real estate development projects. The second risk measure, % Brokered Deposits, averaged 4.4% for urban thrifts and 3.1% for rural thrifts in 1984. The difference is not statistically significant. It increased to 8.7% for urban thrifts (with a median of 1.9%) and 4.9% (with a median of 0.0%) for rural thrifts in 1987. The difference in both the mean and the median is significant at the 5% level.[8] Urban thrifts are significantly larger than rural thrifts in both the mean and the median (1% level). The proportion of real estate related assets, including mortgage loans and direct holdings of real estate (i.e., debt and equity), is slightly lower than two-thirds for urban as well as rural thrifts. This variable reflects a thrift's exposure

[8] It is possible that thrifts had to sell, during a time of difficulty, their liquid assets to meet the operating losses, which could have led to the increase in the two risk measures, even if the absolute amount of direct investments and brokered deposits did not change. This, however, is not the case. From 1984 to 1987, total assets increased (from an average of $264 million to $372 million for those surviving the whole period), suggesting that change in the two risk measures are driven not by involuntary asset sales but by voluntary investment and funding choices.

Table 1
Summary of the main characteristics of Texas thrifts and the market areas in which they are located
All variables are measured at the end of 1984 unless otherwise noted. Panel A provides an overview of the characteristics of both urban and rural thrifts. Panel B presents the summary statistics of the demographic and economic variables for both urban and rural towns. For the number of thrift branches, data are available only for thrifts located in towns that support a newspaper, resulting in 59 urban and 18 rural observations. Significance levels are based on two-tailed tests of differences between the urban and rural samples.

	Urban			Rural		
	Mean	Median	Standard deviation	Mean	Median	Standard deviation
Panel A. summary statistics for thrifts						
Direct real estate investments/assets	1.0%	0.1%	2.2%	0.9%	0.0%	2.4%
Direct real estate investments/assets (1987)	2.7%	0.5%	5.5%	0.9%	0.0%**	2.5%
Brokered deposits/assets	4.4%	1.0%	8.3%	3.1%	0.0%	6.2%
Brokered deposits/assets (1987)	8.7%	1.9%	14.2%	4.9%**	0.0%**	10.5%
Profitability (ROA)	0.22%	0.4%	2.1%	0.25%	0.4%	1.0%
Total assets (millions of dollars)	351.7	148.7	627.3	154.6***	55.5***	268.6
Loan/assets	75.9%	79.3%	17.1%	77.1%	78.8%	13.9%
Cash/assets	6.8%	4.2%	7.1%	6.0%	3.8%	7.0%
Real estate related assets/assets	63.6%	66.5%	15.7%	64.6%	65.8%	13.1%
Proportion of federally chartered thrifts	20.9%			20.8%		
Proportion of mutual ownership	22.5%			26.4%		
Total number of thrifts	187			72		
Panel B. summary statistics for towns						
Number of thrifts	1.9	1	2.5	1.2***	1.0***	0.5
Number of bank branches	12.8	6	30.4	3.5	3.0***	1.5
Population (thousands)	92.6	24.3	227.7	10.2***	7.1***	7.7
Population density (thousands persons/hect)	119.1	51.3	209.1	18.1***	13.6***	14.3
Population growth (1981–1985)	3.1%	2.3%	2.9%	1.1%***	1.0%***	1.8%
Personal income growth (1981–1985)	7.4%	7.4%	1.3%	7.1%	7.2%	1.3%
Total number of towns	98			62		

Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

to the real estate sector. It is not, however, an indication of ex ante risk because the thrift's main business is mortgage lending.

Panel B displays the demographic and economic variables for the market areas (i.e., towns). In urban areas, there are on average 1.9 thrifts (with a median of 1) and 12.8 bank branches per city (with a median of 6). The numbers of thrifts and bank

branches are lower in rural areas. The differences are statistically significant (1% level), except for the mean comparison of the number of bank branches. Moreover, compared with rural areas, urban market areas have significantly (1% level) larger populations, greater population densities, and faster population growth.

4. Empirical findings

In this section, I examine the relationship between market structure and risk taking. First, I investigate whether market concentration leads higher franchise value. Second, I investigate whether higher franchise value discourages risk taking.

4.1. Hypothesis 1: market concentration leads to higher franchise value

I estimate the following equation using ordinary least squares regressions:

$$FV_{ik} = \alpha_0 + \alpha_1 INVCON_k + \alpha_2 LPROF_{ik} + \alpha_3 X_{ik} + \alpha_4 Y_k + \varepsilon_{ik}, \quad (2)$$

where i indexes the firms and k indexes the towns in which the firms are located. FV_{ik} is the franchise value, defined to be earnings before extraordinary items normalized by assets (ROA) in 1984. For banking firms, as interest expenses are generally considered as part of operating costs, it is standard to use earnings normalized by assets instead of equity (see Gilbert, 1984). Moreover, return on equity depends on the book capital, which is, in this particular setting, contaminated by the shock. $INVCON_k$ is the (inverse) measure of market concentration: the log of one plus the number of thrifts in town. $LPROF_{ik}$ is the one-year lag of ROA. X_{ik} represents firm control variables, including the natural log of assets (in millions of dollars) to control for returns to scale, loans as a percentage of assets to capture the effect of asset composition, and cash as a percentage of assets to account for internal liquidity. I also control for the charter type and the organizational form by including dummy variables for federally chartered thrifts and for mutual thrifts. Y_k represents the local economic and demographic variables, including the natural log of personal income, per capita income growth between 1981 and 1985, population density, and population growth between 1981 and 1985.

As reported in Table 2, the coefficient on the number of thrifts is, as expected, negative and significant (5% level). The coefficient on past earnings is, as expected, significantly positive. Among the local variables, only population density is significant (5% level). This could be because the effect of the local business environment, which does not change much over time, is already reflected in past earnings. When I drop past earnings from the estimation, however, the coefficients are still insignificant. The other possibility is that market concentration is also related to local characteristics. When I drop the market concentration measure, the coefficients do not change much, but the R^2 is reduced by almost one-half (not reported), suggesting that market concentration has an independent effect on franchise value. None of the firm control variables is significant, nor are the dummies for federal charter or mutual institutions.

Table 2
The ordinary least squares regressions relating franchise value to market concentration
The sample consists of 252 thrifts in 1984, of which 187 are urban thrifts and 72 are rural thrifts. The dependent variable in all columns is franchise value measured as the earnings before extraordinary items normalized by the book value of assets. Log (1+ number of thrifts) is the log of 1 plus the number of thrifts in the town. The concentration dummy is a dummy variable equal to one if there is one thrift in town and zero otherwise. The competitive dummy is a dummy variable equal to one if there are four or more thrifts in town and zero otherwise. MSA = metropolitan statistical area. In addition to the variables reported, the regressions include an intercept. Column 1 is estimated based on the whole sample; Column 2 is based on the urban thrifts; Column 3 is based on the rural thrifts; and Columns 4 and 5 are based on the urban thrifts. Heteroskedasticity-consistent standard errors are reported in parentheses. Significance levels are based on two-tailed tests.

Independent variable	All (1)	Urban (2)	Rural (3)	Urban (4)	Urban (5)
Market concentration					
Log (1+number of thrifts)	−0.013**	−0.017**	−0.007		−0.022***
	(0.005)	(0.006)	(0.007)		(0.008)
Number of bank branches (thousands)					−0.001
					(0.108)
Concentration dummy × size				0.000	
				(0.000)	
Competitive dummy × size				−0.001***	
				(0.000)	
Demographic characteristics					
Population growth	0.002	0.001	−0.004	0.001	0.005
	(0.009)	(0.012)	(0.012)	(0.012)	(0.026)
Log (total personal income)	0.000	0.001	−0.004**	0.002	0.003
	(0.001)	(0.002)	(0.002)	(0.002)	(0.003)
Per capita income growth	0.002	0.000	0.006	0.005	−0.015
	(0.015)	(0.021)	(0.012)	(0.021)	(0.031)
Population density	0.022**	0.026**	0.212	0.020	0.027
	(0.009)	(0.011)	(0.134)	(0.021)	(0.021)
Firm characteristics					
Firm is located in an MSA	−0.001				
	(0.003)				
Past profitability	0.125*	0.061	0.503***	0.005	0.049
	(0.072)	(0.090)	(0.098)	(0.021)	(0.103)
Dummy for a federal charter	0.003	0.002	0.003	0.001	0.003
	(0.003)	(0.004)	(0.003)	(0.012)	(0.005)
Dummy for a mutual charter	−0.001	−0.002	−0.000	−0.002	−0.002
	(0.003)	(0.004)	(0.002)	(0.002)	(0.005)
Log (book value of assets)	−0.000	−0.000	−0.000	0.000	−0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Loan/assets	0.008	0.006	0.008	0.006	0.010
	(0.007)	(0.009)	(0.008)	(0.009)	(0.014)
Cash/assets	0.003	−0.008	0.019	−0.009	−0.008
	(0.018)	(0.024)	(0.017)	(0.024)	(0.033)
R^2	0.05	0.06	0.39	0.08	0.09
Number of observations	259	187	72	187	96

Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

One alternative interpretation of the results is related to structural differences between urban and rural thrifts. According to Petersen and Rajan (1995), in rural areas, information about borrowers may be more available, or the pressure to repay debt may be greater, which means that rural thrifts should have higher profitability. Meanwhile, rural markets are more concentrated, with an average of 1.2 thrifts versus 1.9 thrifts in urban areas ($t = 3.00$). Therefore, rural thrifts could be driving the results in Table 2. To examine this possibility, I run separate regressions on urban and rural thrifts. In Columns 2 and 3 of Table 2, both regressions have a better fit than the pooled sample has. For urban thrifts, the market-concentration coefficient becomes larger in absolute value (with a slightly lower p-value). The coefficient on past earnings becomes smaller and insignificant, suggesting that, for urban thrifts, franchise value comes mainly from fewer competitors instead of from operating efficiency. For rural thrifts, the coefficient on market concentration has the predicted sign but it is not statistically significant. This is probably because there is not much variation in market concentration in rural areas (85% of the rural thrifts are monopolies in their local markets). The coefficient on past earnings is positive and significant, indicating that the relative performance of rural thrifts depends on management and operations. As evidence in the later sections suggests that the real estate crisis seems not to have extended into the rural areas, I focus on urban thrifts in the remainder of this section.

Another interpretation of results in Table 2 is that in concentrated markets, as pointed out by Demsetz (1973), a larger fraction of output is produced by larger and more efficient firms, which could be driving the positive relationship between concentration and returns. This argument, however, does not seem to apply here. At a crude level, the correlation between the number of thrifts and asset size is significantly positive (0.383 with a p-value of 0.000), rather than negative. The concentrated markets (those with only one thrift) are dominated by small and medium-size thrifts, whereas in the competitive markets (those with four or more thrifts), thrifts are evenly distributed across size classes. In particular, in concentrated markets, 58% of thrifts have assets below \$100 million; 34% between \$100 million and \$500 million; and only 8% above \$500 million. In competitive markets, the respective figures are 25%; 37%; and 39%. In addition, the coefficients on asset size (Column 1 of Table 2) are not statistically significant. When I drop size from the estimation, the concentration coefficients remain qualitatively unchanged. To further examine Demsetz's argument, I create dummy variables for concentrated and competitive markets and let them interact with size. If Demsetz's argument holds, the coefficient on the concentration dummy variable interacting with size should be positive. In Column 4 of Table 2, inclusion of the interaction terms increases the overall fit (the R^2 increases by 2 percentage points even after the adjustment for degrees of freedom). The coefficient on the concentration dummy variable interacting with size is insignificant. The coefficient on the interaction term between the competitive-market dummy variable and size is significant and negative, suggesting that competition hurts larger thrifts more than it hurts smaller ones. Several studies report a strong negative relationship between bank size and small business lending (see, e.g., Berger et al., 1995; Berger and Udell, 1996; Peek and

Rosengren, 1996). Small banks generally devote more resources to local markets and thus acquire a competitive advantage in lending to local customers. This effect can be especially strong in the thrift industry because mortgage lending is locally based. Therefore, contrary to the view that large thrifts in concentrated markets are efficient, the evidence suggests that large thrifts in competitive markets perform poorly.

Lastly, I perform several robustness checks. First, I check whether the results are robust to competition from commercial banks. Barth (1991) reports that regulatory changes in the 1970s and early 1980s led to more direct competition between thrifts and commercial banks. Although Texas state law limited branching until 1988, banks are reported to have used the multiple-bank holding company structure to evade this restriction (Amel, 1995). I control for competition from commercial banks by including the number of bank branches in the regression (Column 5 of Table 2). As these data are available only from towns that have local newspapers, I lose 91 observations. The coefficient on the number of bank branches is small and insignificant.[9] The significance level of the market-concentration coefficient as well as the overall fit of the regression are both much higher. These results, however, perhaps do not stem from the inclusion of an additional variable, but from the loss of 91 observations. Indeed, when I rerun the regression in Column 2 on this smaller sample, I obtain basically the same estimates. Second, I try alternative measures of market structure (unreported): the *n*-bank concentration ratio, defined to be the proportion of deposits or assets held by the largest *n* firms, and the Herfindahl Index, which incorporates both the number of firms and their size distribution. Although results are qualitatively similar, the regressions have a worse fit and the coefficients on the concentration measures are less significant (dropped to the 10% level). Last, one may criticize that the test does not control for portfolio risk or loan mix. Risk itself, however, is endogenously determined. With only exogenous variables as instruments, the regressions should yield unbiased coefficient estimates of market concentration and thus of franchise value in the second-stage regression. When I control for the loan mix using the percentage of commercial and industrial loans and real estate assets (unreported), the earlier results remain qualitatively unchanged.

In sum, this section provides evidence in support of the hypothesis that market concentration leads to higher franchise value. It also serves as the first stage of the two-stage regressions and the predicted value of franchise value generated is an input to the second-stage tests in Section 4.2.

4.2. *Hypothesis 2: higher franchise value reduces risk taking*

Testing the relationship between franchise value and risk occurs in two steps. First, I confirm the "bang-bang" strategies by examining the dispersion of asset risk

[9] Given that bank entry is also highly regulated, the number of bank branches may correlate with the number of thrifts. Indeed, the correlation is 0.788 with a *p*-value of 0.000. However, there is no significant multicollinearity problem in the regression: the maximal condition index is 58 with only two condition indices above 30.

and the likelihood for thrifts to increase risk. Second, I test for a more negative relationship between risk and franchise value.

4.2.1. Increased dispersion of risk levels

A commonly used measure of dispersion is variance. However, "bang-bang" strategies may not result in a higher variance if a large proportion of thrifts goes to the same extreme. Therefore, I look at two other statistics that are less sensitive to shifts in means, namely, the distance between the top and bottom quartile and between the 90th and 10th percentiles of the risk measures. To control for industry wide changes, I use the U.S. thrifts (excluding Texas) as the control sample.

Table 3 presents both the means and the three measures of risk dispersion for Texas and U.S. thrifts at the end of 1984 and 1987. For both risk measures, the average risk doubled during this period in the Texas thrifts. Direct real estate investment rose from 0.96% in 1984 to 2.28% in 1987; brokered deposits rose from 3.96% to 7.68%. In the control sample, the changes were small (from 0.24% to 0.33% for direct investments and from 1.40% to 1.14% for brokered deposits). Compared with the control sample, Texas thrifts were more risky in both measures prior to the shock. Until the Garn-St Germain Depository Institutions Act (DIA) of 1982, federally chartered thrifts had less investment power (including equity investments in real estate) compared with Texas's state-chartered thrifts. Moreover, before 1982, stock institutions could not obtain a federal charter. Nationally, most thrifts were organized as mutual entities whereas in Texas most were stock thrifts. Thus, the majority of Texas thrifts were state-chartered stock institutions with greater investment power.

For % Direct Real Estate Investment (Panel A), both the Texas and the control samples exhibit greater dispersion in 1987 than in 1984.[10] The magnitude, however, is larger for Texas thrifts: 25 basis points for Texas versus 8 basis points in the variance, and a similar pattern for the other two dispersion measures. For % Brokered Deposits (Panel B), all three dispersion measures roughly doubled in the Texas sample. They either declined slightly (for variance) or stayed unchanged in the control sample. I next evaluate the significance of changes in dispersion measures. Within each sample, distributions before and after the shock are unlikely to be independent. To control for sample dependence, I use the bootstrap technique to find the standard errors of the test statistics. The *t*-statistics are reported in Table 3 under the corresponding statistics. In the Texas sample and for both measures of risk, all three measures of dispersion are significantly higher in 1987 than in 1984 (1% level). In the control sample, the change in dispersion is either not statistically significant or significantly lower (in the case of the variance of % Brokered Deposits). The last column displays the "differences in differences", i.e., the

[10] Survivorship bias does not affect my tests. To the extent that the failed thrifts were more risky, survivorship will bias against finding the predicted relationships. As to the new thrifts created between 1984 and 1987, they had on average significantly higher risks. The results, however, are not sensitive to the inclusion or exclusion of new entries. To be conservative, I only report results from the sample of thrifts that existed in 1984.

Table 3
Dispersion of Asset Risk, Texas versus the U.S.
This table presents, for each dispersion variable, the tests of equality between 1984 and 1987, as well as the difference in the change of dispersion between the Texas and the U.S. samples. In Panel A, risk is measured by the ratio of direct real estate investment to total assets; in Panel B, risk is measured by the ratio of brokered deposits to total assets. The standard errors of the test statistics are estimated using the bootstrap technique. The *t*-statistics are in parentheses. Significance levels are based on two-tailed tests.

	Texas			United States			Difference in changes (Texas - United States)
	1984	1987	Change	1984	1987	Change	
Panel A. % direct investment in real estate as the risk measure							
All thrifts							
Mean	0.96%	2.28%	1.32%	0.24%	0.33%	0.10%	1.23%
Variance	0.05%	0.30%	0.25%***	0.02%	0.10%	0.08%	0.17%***
			(3.42)			(0.20)	(3.17)
Distance between top and bottom quartile	0.88%	2.20%	1.32%***	0.61%	1.48%	0.87%	0.45%***
			(3.96)			0.00	(4.06)
Distance between 90th and 10th percentile	2.55%	6.40%	3.85%***	3.12%	5.08%	1.96%	1.89%***
			(2.93)			(1.39)	(2.86)
Number of observations	259	233		2,893	2,617		
Urban thrifts							
Mean	0.95%	2.71%	1.76%	0.26%	0.31%	0.05%	1.71%
Variance	0.05%	0.30%	0.25%***	0.02%	0.03%	0.01%	0.24%***
			(2.61)			(1.63)	(2.57)
Distance between top and bottom quartile	0.99%	2.50%	1.51%***	0.00%	0.00%	0.00%	1.51%***
			(4.03)			n.a.	(3.70)
Distance between 90th and 10th percentile	2.38%	9.00%	6.62%***	0.23%	0.35%	0.12%	6.50%***
			(2.86)			(2.98)	(2.81)
Number of observations	187	168		1,473	1,409		
Rural thrifts							
Mean	0.98%	0.88%	−0.10%	0.11%	0.30%	0.19%	−0.29%
Variance	0.06%	0.00%	−0.06%	0.01%	0.11%	0.10%	−0.16%
			(−1.48)			(1.60)	(0.00)

Table 3 (*continued*)

	Texas			United States			Difference in changes (Texas - United States)
	1984	1987	Change	1984	1987	Change	
Distance between top and bottom quartile	0.47%	0.60%	0.13%	0.00%	0.00%	0.00%	0.13%
			(0.15)			n.a.	(0.00)
Distance between 90th and 10th percentile	2.95%	3.50%	0.55%	0.07%	0.18%	0.11%	0.44%
			(−0.41)			(3.21)	(−0.00)
Number of observations	72	65		1,254	1,208		
Real estate related assets > 50%							
Mean	1.04%	2.78%	1.74%	0.24%	0.33%	0.10%	0.02
Variance	0.06%	0.30%	0.24%***	0.02%	0.10%	0.08%	0.2%***
			(4.91)			(0.20)	(4.15)
Distance between top and bottom quartile	1.09%	2.80%	1.71%***	0.61%	1.48%	0.87%	0.8%***
			(539.62)			0.00	(533.71)
Distance between 90th and 10th percentile	2.55%	9.00%	6.45%***	3.12%	5.08%	1.96%	4.5%***
			(172.21)			(1.39)	(156.65)
Number of observations	157	140		2,893	2,617		
Panel B. % brokered deposit as the risk measure							
All thrifts							
Mean	3.96%	7.68%	3.72%	1.40%	1.14%	−0.26%	3.98%
Variance	0.59%	1.86%	1.27%***	0.31%	0.18%	−0.13%***	1.40%***
			(6.30)			(3.37)	(7.08)
Distance between top and bottom quartile	4.54%	8.40%	3.86%***	0.00%	0.00%	0.00%	3.87%***
			(3.10)			n.a.	(3.30)
Distance between 90th and 10th percentile	11.82%	24.44%	12.62%***	2.86%	2.85%	−0.01%	12.64%***
			(3.53)			(0.04)	(3.58)
Number of observations	255	237		2,617	2,617		
Urban thrifts							
Mean	4.35%	8.69%	4.34%	1.60%	1.24%	−0.37%	4.71%
Variance	0.69%	2.01%	1.32%***	0.36%	0.18%	−0.18%	1.50%***
			(6.38)			(3.54)	(7.40)

Distance between top and bottom quartile	4.69%	11.38%	6.69%***	0.00%	0.00%	0.00%	6.69%***
			(3.47)			n.a.	(3.63)
Distance between 90th and 10th percentile	13.13%	26.92%	13.79%***	3.64%	3.35%	−0.29%	14.08%***
			(3.34)			(0.47)	(3.38)
Number of observations	177	165		1,409	1,409		
Rural thrifts							
Mean	3.08%	4.92%	1.84%	1.16%	1.02%	−0.13%	1.98%
Variance	0.38%	1.09%	0.71%	0.26%	0.19%	−0.07%	0.79%
			(0.02)			(0.01)	(1.09)
Distance between top and bottom quartile	2.66%	5.80%	3.14%	0.00%	0.00%	0.00%	3.15%
			(0.02)			n.a.	(1.09)
Distance between 90th and 10th percentile	10.69%	15.22%	4.53%	1.96%	2.23%	0.27%	0.00%
			(0.01)			(0.60)	(0.58)
Number of observations	70	65		1,208	1,208		
Real estate related assets > 50%							
Mean	3.90%	7.76%	3.86%	1.40%	1.14%	−0.26%	4.12%
Variance	0.57%	1.84%	1.27%***	0.31%	0.18%	−0.13%	1.40%***
			(6.20)			(3.37)	(6.77)
Distance between top and bottom quartile	4.46%	8.57%	4.11%***	0.00%	0.00%	0.00%	4.11%***
			(3.56)			n.a.	(3.40)
Distance between 90th and 10th percentile	11.63%	24.24%	12.61%***	2.86%	2.85%	−0.01%	12.63%***
			(3.10)			(0.04)	(3.18)
Number of observations	212	197		2,617	2,617		

Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively. n.a. = not applicable (because of division by zero).

differences of the changes in the risk dispersion between the Texas sample and the control sample. For both measures of risk, the increase in all three dispersion measures in the Texas sample is significantly higher than that in the U.S. control sample (1% level). Following convention, I report the significance levels based on two-sided p-values even though I am testing a one-sided hypothesis.

An alternative explanation relates to the scope of the shock. The shock might not have hit all the thrifts. If the affected group changed their risks in the same way (e.g., all increased or decreased risks instead of going to the two extremes) and if the unaffected group remained at the same risk level, an increase in variance would be observed for the whole sample. The other two dispersion measures may or may not change depending on which thrifts were affected. I split the sample into urban and rural thrifts and reran the tests. Table 3 shows that the results remain qualitatively unchanged (but stronger) for urban thrifts and disappear for rural thrifts, suggesting that rural thrifts were not hit by the shock. This is probably because, as reported by Horvitz (1990), over-building, a necessary condition for a collapse in real estate prices, occurred mainly in cities. Lastly, I reran the tests on a subsample of Texas thrifts that held in 1984 more than half of their investments in real estate related assets, a group that had significant exposure to the real estate sector. Again, the results remain the same but are somewhat stronger.

To summarize, the Texas sample shows significant increases in dispersion for both measures of risk after controlling for the changes at the national level. An increased dispersion, however, does not necessarily indicate that thrifts followed "bang-bang" strategies because some thrifts going to one extreme would also increase risk dispersion. Moreover, the possibility that thrifts randomly chose the two polar risk strategies cannot be completely ruled out. Therefore, it is important to identify which thrifts actually increased or decreased risk, which is done in the next subsection.

4.2.2. Direction of the change in risk levels

I estimate a linear probability model using a two-stage least squares (2SLS) regression to investigate the factors that are related to the directions of the risk changes. I choose to use this model because of its simplicity, especially in the presence of endogenous explanatory variables. As my main focus is not prediction but the average effect of market structure on the direction of the change in risk, the shortcomings of the linear probability model (e.g., predicted probabilities outside the range of zero and one) do not pose serious problems.

The first-stage regression is the same as Eq. (2):

$$FV_{ik} = \alpha_0 + \alpha_1 INVCON_k + \alpha_2 LPROF_{ik} + \alpha_3 X_{ik} + \alpha_4 Y_{ik} + \varepsilon_{ik}. \tag{3}$$

The second-stage regression is

$$RESPONSE_{ik} = \gamma_0 \widehat{FV}_{ik} + \gamma_1 X_{ik} + \eta_i, \tag{4}$$

where $\widehat{FV}_{ik}$ is the predicted value of franchise value and X_{ik} consists of firm control variables as defined in Eq. (2). The second-stage dependent variable, $RESPONSE_{ik}$, falls into one of three ordered categories: zero if the thrift decreased its risk (i.e.,

reduced its percentage of direct holdings of real estate or brokered deposits); one if the thrift increased its risk (i.e., increased its percentage of direct holdings of real estate or brokered deposits); and two if the thrift failed between 1984 and 1987.[11] Twenty-six thrifts, or 10% of the sample, failed during the sample period. If I ignore the failed thrifts, there would potentially be a survivorship bias. However, some thrifts may have gambled and won or even if they did not win they perhaps did not fail because of regulatory forbearances. In such a case, the category of failure contains only a proportion of high-risk thrifts, which biases against finding any relationship. Later, I check the robustness of the results by estimating a Heckman selection model with endogenous variables.

Panels A and B of Table 4 report the results for the two measures of risk. Because of the structural differences in urban and rural thrifts identified earlier, I estimate the model for the two subsamples separately. Columns 1 and 2 of Table 4 report the second-stage results with the first-stage regressions in Columns 2 and 3 of Table 2. In Panel A, where the risk measure is % Direct Real Estate Investment, the coefficient on the predicted franchise-value proxy is negative and statistically significant (5% level) for urban thrifts but insignificant for rural thrifts. The results in Panel B are similar but weaker for urban thrifts. The coefficient on the predicted franchise-value proxy is negative and is marginally significant at the 15% level and thus significant at 10% based on a one-sided test. As the hypothesis on the effect of franchise value is one-sided, this result is supportive of the disciplinary role of franchise value. As is discussed later, the coefficient becomes significant at the conventional level when I add more controls or adjust for selectivity or both. The franchise-value coefficient is insignificant for rural thrifts, confirming that, coupled with the findings in Section 4.2.1, the real estate crisis did not extend into rural areas. I focus on urban thrifts in what follows.

Somewhat surprisingly, the coefficient on the federal-charter dummy variable is positive, with significance levels of 15% for % Direct Real Estate Investment and 1% for % Brokered Deposits. In general, as indicated by Barth (1991), federal regulators provided more stringent oversight than did state regulators. This, however, did not seem to be the case for Texas.[12] In 1983, when the FHLBB district headquarter moved from Little Rock to Dallas, only 75% of the staff made the move, which weakened its supervisory capacities (White, 1991). Wang et al. (1987) report that most thrifts were not examined at all between 1983 and 1985. A study by the American Council of State Savings Supervisors (1991) also shows that federal thrifts had higher failure rates than did state institutions in Texas. In addition, as federal thrifts were allowed greater investment power only after the Depository Institutions Act of 1982, they might have adjusted their portfolios in the few years after 1982. The coefficients on the dummy variable for the mutual thrifts are,

[11] I also try finer definitions of the response variable with five, instead of three, outcomes (decreased risk a lot, decreased risk a little, increased risk a little, increased risk a lot, and failed), with 5 and 95 (and 10 and 90) as cutoffs. The results are similar and in some cases stronger (e.g., for % Direct real estate investment, the coefficient on the interaction between the high-leverage dummy and predicted franchise value in Column 4 of Table 4 becomes significant).

[12] I thank the referee for pointing this out to me.

Table 4
Linear-probability regression analysis of the relationship between the direction of risk change and franchise value
This table presents the two-stage least squares (2SLS) estimates linking market structure, franchise value, and the direction of change in risk. The regression coefficients are estimated using 2SLS:

$$RESPONSE_{ik} = \gamma_0 + \gamma_1 \widehat{FV}_{ik} + \gamma_2 X_{ik} + \eta_{ik},$$

where X_{ik} contains the firm control variables and $\widehat{FV}_{ik}$ is the predicted value of franchise value generated in the first-stage regression. The first-stage regression is estimated in Columns 1 and 2 of Table 2. In Panel A, risk is measured by the ratio of direct real estate investment to total assets; in Panel B, risk is measured by the ratio of brokered deposits to total assets. In Columns 1–4, *RESPONSE* equals zero if the risk measure decreased, one if the risk measure increased, and two if a thrift failed during the sample period. In Columns 5–7, *RESPONSE* is defined for the sample of thrifts that survived between 1984 and 1987 and equals to zero if the risk measure decreased, one if the risk measure increased; the models are estimated with a probit selection equation. Franchise value is measured as the ratio of earnings before extraordinary items to the book value of assets in 1984. The Bigthrift dummy is a dummy variable equal to one if the thrift has assets over $1 billion and zero otherwise. In addition to the variables reported, the regressions include an intercept. The Durbin–Wu–Hausman statistic tests the null hypothesis that instrumental variables do not change the estimation outcome. Heteroskedasticity-consistent standard errors are reported in parentheses. Significance levels are based on two-tailed tests.

Independent variable	Two-stage least squares regressions				Heckman selection model		
	Urban (1)	Rural (2)	Urban (3)	Urban (4)	Urban (5)	Urban (6)	Urban (7)
Panel A. % direct investment in real estate as the risk measure							
Franchise value							
Predicted franchise value	−24.356**	−1.92	−27.568***	−31.557***	−32.361**	−31.675***	−35.220***
	(11.247)	(12.059)	(8.886)	(11.339)	(15.129)	(11.155)	(12.188)
Bigthrift dummy × predicted franchise value			96.212***	101.005***		29.239	27.529
			(34.895)	(35.202)		(35.404)	(35.638)
High-leverage dummy × predicted				9.487			15.62
franchise value				(16.291)			(20.075)
Firm characteristics							
Firm has a federal charter	0.236[a]	0.358*	0.253*	0.264**	0.107	0.117	0.123
	(0.164)	(0.210)	(0.128)	(0.128)	(0.155)	(0.116)	(0.117)
Firm has a mutual charter	−0.167	−0.360*	−0.16	−0.182	−0.036	−0.040	−0.026
	(0.161)	(0.194)	(0.126)	(0.126)	(0.169)	(0.128)	(0.129)
Log (book value of assets)	0.058	0.081	0.027	0.021	−0.009	−0.021	−0.022
	(0.042)	(0.063)	(0.035)	(0.035)	(0.045)	(0.037)	(0.037)
Loan/assets	0.650*	−0.038	0.672**	0.666**	0.308	0.319	0.305
	(0.344)	(0.585)	(0.269)	(0.269)	(0.326)	(0.243)	(0.246)
Cash/assets	1.080	0.101	1.258*	1.218*	0.036	0.092	0.117
	(0.817)	(1.191)	(0.643)	(0.640)	(0.836)	(0.634)	(0.638)

High leverage dummy				0.126			−0.059
				(0.089)			(0.098)
Inverse Mills ratio							
					0.068	−0.026	−0.038
					(1.306)	(0.277)	(0.279)
R^2	0.06	0.08	0.08	0.14	0.08	0.09	0.09
Observations	187	72	187	187	167	167	167
Durbin–Wu–Hausman	5.30***	0.65	5.13***	7.92***	10.28***	5.29***	3.54***
Panel B. % brokered deposits as the risk measure							
Franchise value							
Predicted franchise value	−15.799[a]	−1.944	−14.815[a]	−21.617*	−17.741*	−17.740*	−24.482**
	(11.552)	(16.813)	(11.649)	(12.602)	(9.871)	(9.869)	(11.372)
Bigthrift dummy × predicted			49.696	48.096		−0.001	−7.535
franchise value			(78.996)	(80.190)		(0.018)	(16.496)
High leverage dummy × predicted				16.759			18.271*
franchise value				(18.745)			(11.378)
Firm characteristics							
Firm has a federal charter	0.305***	0.191	0.288**	0.292***	0.213**	0.213**	0.221**
	(0.110)	(0.227)	(0.111)	(0.112)	(0.103)	(0.103)	(0.105)
Firm has a mutual charter	−0.325***	−0.136	−0.306***	−0.308***	−0.249**	−0.249**	−0.233**
	(0.114)	(0.223)	(0.114)	(0.114)	−0.110	−0.110	−0.109
Log (book value of assets)	0.063*	−0.019	0.057	0.056	0.038	0.038	0.041
	(0.036)	(0.062)	(0.037)	(0.037)	(0.026)	(0.026)	(0.027)
Loan/assets	0.836***	0.355	0.795***	0.779***	0.533***	0.533***	0.534**
	(0.271)	(0.518)	(0.273)	(0.269)	(0.202)	(0.202)	(0.211)
Cash/assets	1.370**	0.15	1.425**	1.450**	0.647	0.647	0.677**
	(0.676)	(0.723)	(0.679)	(0.675)	(0.479)	(0.478)	(0.327)
High-leverage dummy				−0.026			−0.131
				(0.082)			(0.084)
Inverse Mills ratio							
					−0.238	−0.191	−0.18
					(0.251)	(0.252)	(0.250)
R^2	0.11	0.02	0.11	0.12	0.05	0.07	0.09
Number of observations	183	71	183	183	165	165	165
Durbin–Wu–Hausman	0.79	0.18	0.38	0.57	4.24***	4.34***	2.94***

Significance at the 1%, 5%, and 10% levels is indicated by ***, **, and *, respectively.

[a] Indicates marginally significant coefficient estimates at the 15% level based on two-sided tests and thus the 10% level based on one-sided tests.

consistent with Esty (1997), negative and significant for % Brokered Deposits (1% level), although not significant for % Direct Real Estate Investments. In the % Direct Real Estate Investment regressions (Panel A), firm size does not have any significant effect, nor does the ratio of cash to total assets. The coefficient on the ratio of loans to assets is positive and significant (10% level). In the % Brokered Deposits regressions (Panel B), coefficients on firm size, the loan-to-assets ratio, and the cash-to-assets ratio all are positive and significant (5% or 1% level).

The findings in Section 4.1 that large thrifts tend to be less profitable in competitive markets raises some concern about the second-stage results. Large firms with low franchise value may increase risk whenever possible based on the presumption of "too big to fail", resulting in a negative relationship between franchise value and risk taking. To investigate this possibility, I add an interaction term between the predicted value of profitability and a big-thrift dummy variable for thrifts with assets over $1 billion before the shock.[13] The "too-big-to-fail" hypothesis suggests that franchise value cannot contain risk taking for big thrifts, which implies a positive sign on the interaction term and a zero coefficient on franchise value for big thrifts. Column 3 in Panel A of Table 4 shows that, in the % Direct Real Estate Investment regressions, the coefficient on the interaction term is, as predicted, significantly positive. The sum of the coefficients on franchise value and on the interaction term is significantly positive, rather than zero, with a p-value of 0.051 in a two-sided test. As is discussed later, this result is driven by the failed thrifts (the failure rate was 36% among big thrifts and 10% among the whole sample). In Panel B where % Brokered Deposits is the risk measure, the interaction term is positive but insignificant. For both risk measures, the coefficient on franchise value itself maintains the same sign and significance level, indicating that, for the vast majority of thrifts, franchise value has a disciplinary effect.

So far, I do not control for the capital ratio or leverage. Both book values and market values of capital ratios matter in banking; the former mainly for regulatory reasons, the latter mainly for incentives. The two measures of leverage are of course related, especially when a thrift is close to default or violating the regulatory minimum. As most thrifts are not publicly traded (there were only five public thrifts in Texas during the sample period), only book leverage data are available. Most likely, thrifts determine their book values of leverage and asset risks simultaneously. It is difficult, however, to estimate a capital-ratio equation, because capital ratios depend on earnings, which are contaminated by the shock. If the error terms in these two equations are not correlated, the estimation is unaffected. If they are correlated, estimating the risk equation separately loses some efficiency as it cannot make use of

[13] The banking literature commonly defines large banks as the 95th percentile of bank assets (e.g., Kashyap and Stein, 2000; Ashcraft, 2001). The $1 billion cutoff results in 14 thrifts or 6% of the sample being classified as big thrifts, which is roughly consistent with the common practice of using the 95th percentile. In 1988, the average asset size of failed thrifts was $50 million, with the largest being $1.9 billion (Barth, 1991). It seems reasonable to assume that, in addition to stability considerations, because of very limited cash available to the Federal Savings and Loan Insurance Corporation, the FHLBB was reluctant to foreclose such big thrifts if they were troubled. The results are robust to the alternative cutoff of the 90th percentile.

the information contained in the correlation of the disturbance terms. Given the difficulty in estimating the capital-ratio equation, this sacrifice of efficiency may be worthwhile. Nevertheless, the model in the Appendix suggests that the incentive to take risk depends on leverage as well as franchise value. Thrifts with high leverage and low franchise value have the greatest incentive to take risk. Therefore, introducing leverage can sharpen the hypotheses.[14] I create a dummy variable for high-leverage thrifts (whose leverage is above the median) and interact it with predicted franchise value. Even if leverage itself is endogenous, the dummy variable and the interaction term are not likely to be endogenous. Inclusion of the high-leverage dummy and its interaction terms therefore allows for the effect of leverage without introducing endogeneity problems. Both coefficients are expected to be positive. Column 4 of Table 4 reports the effect of leverage. For both measures of risk, including the leverage-related variables increases the overall fit of the regressions and the precision of the coefficient estimate of franchise value, as reflected in higher significance levels. The high-leverage dummy variable and its interaction term themselves are not significant. This is probably because the market value of leverage, not the book value of leverage, is most relevant to risk-taking incentives. Using the book value of leverage therefore introduces noise to the coefficient estimates of the leverage-related variables.[15]

The results reported so far are based on the linear probability model because of its simplicity. As a robustness check, instead of putting the failures into one of the RESPONSE categories, I correct for the survivorship bias by estimating a Heckman selection model with endogenous variables according to the procedure in Wooldridge (2002). This procedure involves two steps. The first step is a probit regression of survival on all the exogenous variables, which generates the inverse Mills ratio. In the second step, the following equation is estimated by 2SLS using all the exogenous variables and the inverse Mills ratio as instruments. The no-selection hypothesis is tested based the 2SLS t-statistics of the coefficient estimate of the inverse Mills ratio. As reported in Columns 5–7 of Table 4, the coefficient on the inverse Mills ratio is not statistically different from zero, indicating that the survivorship bias is not a problem. Indeed, most results in Columns 5–7 are qualitatively similar to those obtained earlier. But there are two exceptions. First, for % Brokered Deposits, the coefficient on franchise value and its interaction with the high-leverage dummy variable become significant at conventional levels (5% or 10% level for two-sided tests). Second, the coefficient on the interaction term between the big-thrift dummy variable and franchise value becomes insignificant for % Direct Real Estate Investment. Both changes are driven by the fact that the failed thrifts

[14] I thank the referee for suggesting this to me.

[15] As book-value leverage is most related to managerial incentives when a thrift is close to default or the regulatory minimum, I rerun the tests using the top 90 and 95 percentile as the cutoffs to define high leverage. I obtain similar and in some cases stronger results (the coefficient estimates and their significance levels of the high-leverage dummy become higher). I also create a low leverage dummy using the bottom 5 and 10 percentiles as the cutoffs. I observe less risk taking associated with low leverage though the results are somewhat weaker. These robustness checks suggest that using book leverage to reflect managerial incentives introduces less noise for thrifts with very high leverage.

have similar predicted franchise value to those that did not fail (0.3% on average with a standard deviation of 0.5% vs. 0.23% on average with a standard deviation of 0.36%). That is, franchise value is not a good predictor of failure, probably because of regulatory forbearances. Therefore, treating failure as the category of highest risk reduces the statistical significance of the coefficient estimates of franchise value. Moreover, five out of the 14 big thrifts failed, resulting in a failure rate of more than 36%, which is much higher than that for the whole sample (10%). Treating failure as the category of highest risk could artificially create a relationship between high risk and high franchise value for large thrifts.

In summary, this subsection further establishes that when hit by an exogenous shock, the thrifts adopt "bang-bang" strategies in which those with higher franchise value reduce their risk levels while those with lower franchise value take on more risk. Given this result, testing the relationship between franchise value and risk taking can be transformed into testing for a more negative slope of risk levels with respect to franchise value, which is done in the next subsection.

4.2.3. *A more negative slope of risk levels with respect to franchise value*

I estimate a 2SLS regression model using panel data for the period from 1984 to 1989. The first-stage regression is the same as Eq. (2):

$$FV_{ik} = \alpha_0 + \alpha_1 INVCON_k + \alpha_2 LPROF_{ik} + \alpha_3 X_{ik} + \alpha_4 Y_{ik} + \varepsilon_{ik}, \tag{5}$$

where i indexes the firms and k indexes the towns in which firms are located, and all the variables are defined as in Section 4.1. The second-stage is a linear regression:

$$RISK_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 \widehat{FV}_i SHOCK_t + \delta \widehat{FV}_i + \lambda_i + u_t + \eta_{it}, \tag{6}$$

where i indexes the firms and t indexes years. $RISK_{it}$ is % Direct Real Estate Investments or % Brokered Deposits; X_{it} is the same set of firm controls as in the first-stage regression; $\widehat{FV}_i$ is the predicted franchise value; $SHOCK_t$ is a dummy variable for the shock years, namely, 1986 and 1987;[16] and λ_i and u_t are firm and year fixed effects, respectively. The effect of franchise value is captured in β_2, which is expected to be negative. β_2 can be consistently estimated through the fixed-effect transformation (i.e., within transformation), which fully controls for the fixed differences among firms. Even if franchise value is measured with a bias, as long as the biases in the coefficient estimates are of similar magnitude before and after the shock, β_2 is unbiased.[17]

The fixed-effect method, however, also removes the effect of franchise value and therefore cannot yield any estimate of δ, the coefficient on franchise value itself. To estimate δ, I use the within (fixed-effect) estimates to remove $\bar{X}_{i\cdot}'\beta$ from the between regressor $\overline{RISK}_{i\cdot}$ and use the instruments in the first-stage regression. I find that δ is

[16] The results are robust to alternative definitions of 1985–1987, 1986–1988, and 1985–1988.

[17] The dependent variable in Eq. (6) is censored at zero and one. A Tobit model seems suitable to this situation. However, the Tobit model cannot be estimated with firm fixed effects. Therefore the fixed differences across thrifts cannot be removed. Nevertheless, as a robustness check, I estimate a Chamberlain random-effect Tobit model with endogenous explanatory variables following Smith and Blundell (1986). The results (not reported) are qualitatively the same.

not statistically significant (not reported). Therefore, because of the unobservability of franchise value, it is difficult to test directly for the relationship between franchise value and risk taking, which strengthens the argument that the Texas real estate crisis provides a unique testing ground.

Table 5 reports the second-stage estimates for urban thrifts. In Columns 1 and 2, the risk measure is % Direct Real Estate Investment. Column 1 shows that β_2, the coefficient on the interaction term between the franchise-value proxy and the shock-year dummy variable, enters the equation with a negative sign and is significant at the 10% level. In Column 2, although the leverage-related variables themselves are not statistically different from zero, they increase the statistical significance of the β_2 estimate from the 10% to the 5% level. Columns 3 and 4 report results using % Brokered Deposits as the risk measure. In Column 3, when the leverage effects are not controlled for, β_2 has the expected sign but is not statistically significant. In Column 4, when I add the leverage-related variables, the statistical significance of the β_2 estimate increases to the 10% level. The high-leverage dummy is significantly positive at the 5% level. Its interaction with franchise value is significantly positive at the 10% level.

As further evidence that the results do not pick up the effect of asset size, the coefficients on size are negative and significant at 10% for % Direct Real Estate Investment (Panel A) and marginally significant at 15% for % Brokered Deposits (Panel B). This suggests that, with unobserved heterogeneity at the firm level controlled, larger firms actually tend to hold less risky assets. In the rural sample and for both measures of risk, β_2 is not significant (not reported), suggesting that, consistent with earlier evidence, rural thrifts were not affected by the shock.

The banking literature has long recognized the negative association between risk and profitability. Berger (1995) argues that a lower risk reduces the default risk and therefore lowers the interest payments on uninsured funds, which leads to higher earnings. However, this perhaps is not the whole story. As banks are mainly funded by insured deposits, the interest payment on uninsured debt accounts for only a small portion of the total interest expense and may not drive the significant results. My findings suggest a reverse causality: instead of earnings being affected by risks, to the extent that earnings are serially correlated, banks choose their asset risks in anticipation of their future earnings opportunities.

To summarize, I find that despite the difficulties in directly establishing the relationship between market structure and risk taking, the relationship can be uncovered by examining the behavior of thrifts during the real estate crisis. The findings support the view that thrifts in more concentrated markets are more profitable and are therefore more conservative in their risk choices.

5. Conclusion

I have presented evidence consistent with the view that banking market structure affects risk taking and therefore financial stability. Using the Texas real estate crisis as a natural experiment, I perform two sets of tests. The first set tests for a

Table 5
Market structure, franchise value, and asset risks
This table presents the two-stage least squares estimates of the effect of franchise value on thrift risk level based on the sample of urban thrifts.
The regression coefficients are estimated using 2SLS

$$RISK_{it} = \beta_0 + \beta_1 X_{it} + \beta_2 \widehat{FV}_i * SHOCK_t + \lambda_i + u_t + \eta_{it},$$

where X_{it} contains the firm control variables and $\widehat{FV}_i$ is the predicted value of franchise value generated in the first-stage regression. The first-stage regression is estimated in Columns 2 and 3 in Table 2. In Columns 1 and 2, the dependent variable *RISK* is measured by the ratio of direct real estate investment to total assets; in Columns 3 and 4, *RISK* is measured by the ratio of brokered deposits to total assets. In addition to the variables reported, the regressions include an intercept. The Durbin–Wu–Hausman statistic tests the null hypothesis that instrumental variables do not change the estimation outcome. Heteroskedasticity-consistent standard errors are reported in parentheses. Significance levels are based on two-tailed tests.

Independent variable	% Direct real estate investment		% Brokered deposit	
	(1)	(2)	(3)	(4)
Franchise value				
Franchise value × shock-year dummy	−0.647*	−0.597**	−0.782	−2.300*
	(0.332)	(0.271)	(1.090)	(1.172)
Franchise value × high-leverage dummy		−0.426		3.484*
		(0.424)		(2.096)
Firm characteristics				
Log (book value of assets)	−0.005*	−0.005*	−0.065	−0.070
	(0.003)	(0.003)	(0.046)	(0.047)
Loan/assets	−0.049***	−0.014	−0.066	−0.004
	(0.008)	(0.024)	(0.152)	(0.171)
Cash/assets	−0.016	−0.049***	−0.146	−0.099
	(0.021)	(0.012)	(0.101)	(0.113)
High-leverage dummy		0.001		0.055**
		(0.003)		(0.024)
Number of cross sections	178	178	178	178
Adjusted R^2	0.60	0.60	0.43	0.45
F test on fixed effects	5.30***	5.29***	3.12***	2.91***
Durbin–Wu–Hausman	3.89***	2.6***	0.52	2.09***

Significance at the 1%, 5%, and 10% level is indicated by ***, **, and *, respectively.

relationship between market structure and franchise value. Using data on Texas thrifts, a type of banking institution specializing in mortgage lending, I find that market concentration leads to higher franchise value. The second set of tests focuses on the relationship between franchise value and risk, which is identified through an exogenous shock. I empirically confirm that, when hit by an exogenous shock that wipes out current rents, thrifts adopt "bang-bang" strategies. Testing the relationship between franchise value and risk is thus transformed into testing for a difference in the slopes of risk. I find that the slope becomes more negative after the shock, suggesting that higher franchise value induces thrifts to be more prudent.

The central features of banks in the models predicting a relationship between market structure and risk taking include debt financing, government insurance,

current rents, and future investment opportunities. Thus, although my tests are performed on a sample of thrifts, the results in this paper should apply not only to thrifts, but also to any banking institutions that have the above features. These results lend support to theoretical predictions that, to the extent that it increases competition, financial liberalization could lead to financial instability (e.g., Besanko and Thakor, 1993; Allen and Gale, 2000; Hellmann et al., 2000). To my knowledge, this is the first paper that shows a direct link between banking market structure and financial stability.

This paper also has interesting macroeconomic implications. It is well known that exogenous shocks worsen the asymmetric information problem between borrowers and lenders by changing the borrowers' net worth, which results in a further decline in outputs (e.g., Bernanke and Gertler, 1989; Calomiris and Hubbard, 1990). The results in this paper suggests that the "bang-bang" strategies banks adopt in response to exogenous shocks represent an alternative mechanism that generates macro instability. To the extent that franchise value of banks is correlated, if the majority of banks have high franchise value, they tend to shift into safe assets and cut down on lending, resulting in a credit crunch. When most banks are prone to risk taking, the moral-hazard problem can lead to widespread bank failure, thus amplifying a downturn.

Financial stability achieved from market concentration, or less competition, is not, however, without costs. Market power enables banks to charge higher interest on loans, pay lower interest on deposits, and distort the savings and investment decisions of consumers and producers. Similarly, excessive fees for banking services raise the costs of transactions and distort exchange behaviors (see, e.g., Alhadeff, 1954; Freixas and Rochet, 1997). Finally, without competition, banks tend to operate within the limits of their technical capacities, the so-called X-inefficiency (see, for a survey, Berger and Mester, 1997). This paper complements the literature by pointing out a possible adverse effect of competition; that is, competition can cause excessive risk taking. This effect arises from a unique institutional feature of banking: government deposit insurance (either implicit or explicit). Therefore, regulators face a trade-off between efficiency and stability.

Appendix A

This section provides a simple one-period model showing that when hit by an exogenous shock that wipes out rents on assets-in-place, banks have an incentive to adopt "bang-bang" strategies. Similar to Marcus (1984), the bank manager maximizes the total market value of assets (denoted as W henceforth). With the same notation as in Eq. (1), this is equivalent to maximizing the sum of franchise value (current rents, R, plus the growth opportunity, G) and deposit insurance put options. The growth opportunity, G, can be modeled as a binary option (with the same term as that of the insurance put option); that is, the bank gets a positive NPV equal to π if it does not fail at the end of the period, and zero if it fails. For simplicity, I treat π as certain (not random).

I adopt the standard assumption of a geometric Brownian motion with a constant drift and volatility rate for the process of the underlying asset. Then, by put-call parity and standard option pricing formulae, the bank's value function, W, with zero current rents ($R = 0$) can be written as

$$W = R(I, \sigma) + G + Put(I, \sigma, D) \tag{A.1}$$

$$= I \cdot N(x) - D \cdot N(x - \sigma) + \pi N(x - \sigma) - (I - D) \tag{A.2}$$

where $x = 0.5\sigma + \ln(I/D)/\sigma$, I is the book value of assets, σ is the asset volatility, and D is the book value of debt (which, given the deposit insurance, equals the market value). The sum of the first two terms is a call option on assets-in-place, and the third term is the value of a binary option.

The first-order conditions are

$$W_I = \frac{N'(x - \sigma)}{\sigma I}(\pi - H^0) \tag{A.3}$$

and

$$W_\sigma = \frac{x}{\sigma} N'(x - \sigma)(H^1 - \pi), \tag{A.4}$$

where $H^0 = [(1 - N(x)]\sigma I/N'(x - \sigma)$ and $H^1 = \sigma D/x$. It is easy to verify that $\partial H^1/\partial\sigma > 0$. In the following, I show that $\partial H^0/\partial I < 0$.

$$\partial H^0/\partial I = \frac{-N'(x) + x[1 - N(x)]}{N'(x - \sigma)}. \tag{A.5}$$

Denote the numerator as A. $A_x = 1 - N(x) > 0$. Note that when $I \to +\infty$, $x \to +\infty$. Then, $A < A_{\max} = \lim_{x \to +\infty} A = 0$. Thus, $\partial H^0/\partial I < 0$.

It follows that given its initial position, the bank wants to add or reduce leverage and risk depending on the magnitude of π in comparison with H^0 and H^1. The fact that $\partial H^1/\partial\sigma > 0$ and $\partial H^0/\partial I < 0$ implies that, after it adds or reduces leverage and risk, the bank has more incentive to do so further. As a result, the bank's problem has only corner solutions: banks with high π want to take zero risk whereas banks with low π want to take extremely high risk.

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