Is Mortgage Lending by Savings Associations Special?

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In this paper, we investigate whether elimination of the savings association charter might reduce lending to "nontraditional" (e.g., low-income) mortgage borrowers. We present a theoretical model of lender portfolio choice, in which nontraditional lenders have some market power and traditional lenders are price-takers in the mortgage market. The comparative statics indicate differences between nontraditional and traditional lenders in terms of their asset allocation responses to changes in borrower income and house prices. Empirical tests indicate the absence of such differences between savings associations and commercial banks, suggesting that elimination of the savings association charter would not impair lending to nontraditional mortgage borrowers.

During the past several years, Congress has debated eliminating the federal savings and loan (S&L) industry by merging the federal S&L charter into the commercial bank charter.[1] As the number of savings associations has declined sharply over the past decade (from 2,961 savings banks and savings and loans with either national or state charters in 1986 to 1,997 at the end of 1997), the elimination of the federal S&L charter might seem to be simply one more step in financial consolidation.

Some critics of the plan, however, point out that the initial policy goal of chartering a separate set of depository institutions was to create institutions with a special commitment to a particular type of lending, and, in the case of savings associations, the goal was to have a set of institutions with a special commitment to the housing market. In spite of the rapid growth of mortgage securitization and the prevalence of commercial and mortgage banks in mortgage lending, they argue that a depository institution with a special commitment to mortgage lending still is needed.

According to these critics, commercial and mortgage banks are "cream-skimmers" who make easy real estate loans, but who do not develop the relationships with unusual or nontraditional borrowers, that are required to lend successfully to these borrowers or institutions. A corollary to this view is that commercial banks provide only conforming mortgages that can be sold in the secondary mortgage market, while savings associations make "hard" mortgages that often must be held in the institution's portfolio. As illustrated later, these types of institutions may behave differently in their asset allocation in response to changes in borrower income or house prices. Such differences may provide tests of whether or not special borrowers are served by these institutions.[2]

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1. Under some of these proposals, the regulator of most savings associations (the Office of Thrift Supervision, or OTS) would be consolidated with commercial bank regulators (the Federal Deposit Insurance Corporation, the Office of the Comptroller of the Currency, and the Federal Reserve). The savings association industry has argued that charter elimination, if any, should be of the "charter-up" variety, giving all thrift powers to banks rather than limiting thrift powers to those of banks.

2. Even with a "special commitment" by savings associations, the question persists as to why a special charter is needed to promote this commitment, since most mortgage-related activities, with the exception of some real estate development loans, can be undertaken by an institution

In this paper, we present a theoretical model of lender portfolio choice between home mortgages and an alternative investment in a government security. We distinguish between traditional lenders, who are price-takers in the mortgage market, and nontraditional lenders, who invest in information in order to obtain some market power in a nontraditional mortgage market. We then use realistic parameter values to simulate the comparative statics of the model. These simulations inform the structure of our estimated equations, where we find no evidence that savings associations are more oriented to nontraditional mortgage borrowers than commercial banks. Thus, the savings association charter does not appear to make savings associations behave more like nontraditional lenders.

I. THE GOVERNMENT'S COMMITMENT TO A SPECIAL DEPOSITORY FOR THE HOUSING SECTOR

Savings associations had existed for about 100 years prior to the Great Depression as cooperatives that pooled the savings of members and then made loans to members for housing. But during the 1930s, the federal government transformed the industry into a tool of public policy and made it a symbol of the government's commitment to housing (National Commission 1993).

This tool worked well until the mid-1960s, when the S&L industry encountered the first of many crises. Because the industry funds longer-term mortgages with shorter-term deposits, each market or regulatory development that made it easier for depositors to place their funds elsewhere and receive higher yields placed pressure on industry profitability. By 1970, the need for the S&L industry to adopt new strategies for funding mortgages was evident to many observers, but, as the National Commission (1993) points out, "Congress' insistence that S&Ls continue to function almost totally as vehicles for achieving national housing goals prevented needed adjustments from occurring" (p. 23).

By 1988, the S&L industry was in the midst of a full-blown crisis, but even then the industry and Congress were able to block changes because of a fear that national housing policy would be damaged if the special nature of the S&L were altered.[3] As stated by Danny Wall (1988), Chairman of the Federal Home Loan Bank Board (then regulator of the S&L industry) at the height of the thrift crisis (p. 237):

> …it seems clear to me that the Congress is absolutely committed to this industry, because of the predominance of its responsibility is focused on housing finance….
>
> It is clear to me that the Congress, as the policy maker, wants an industry like this to exist, with a charter in community after community, unlike the mortgage bankers…. Mortgage bankers expand and contract with the market, and that kind of ability is necessary and desirable. On the other hand, in the down times, the savings institution industry has still financed housing.

Now, ten years later, the debate about "modernizing" bank charters still evokes concern that smaller depositories, particularly thrifts, are needed to accomplish important policy goals in housing and community development. For example, Nicolas Retsinas—Assistant Secretary of Housing and Urban Development and Federal Housing Commissioner—states (1997):

> …any proposal to modernize financial services must ensure that institutions are not discouraged and precluded from continuing to concentrate in mortgage lending. Public policy in this country has always recognized the value of promoting home ownership.
>
> …We should not force institutions that focus on housing finance to abandon a business that not only is profitable but also fulfills a very important public purpose.

II. THE DEMAND FOR MORTGAGES AND ASSET ALLOCATION BY FINANCIAL INSTITUTIONS

Banks invest in understanding their customers as part of understanding the risks of lending. Evaluating loan applicants and monitoring loan borrowers allows banks to build up expertise, and this information may then be used to extend credit to borrowers who find it difficult to obtain elsewhere.[4] Savings associations, with higher proportions of lending focused on mortgages, may build up special expertise in the mortgage market.

There are, in essence, two residential mortgage markets: the traditional mortgage market, which usually provides fixed-rate mortgages with a 20 percent down payment to borrowers with well-known credit characteristics, and the nontraditional market. To illustrate how these markets might become segmented, consider a simple model with two types of borrowers—one type that has well-known risk

with either a commercial bank or savings association charter. One answer is that it is the regulator of the industry—in this case the Office of Thrift Supervision—that creates the special commitment because it is focused on the industry and understands it better, and therefore allows more "relationship lending." Beyond this argument, it is difficult to understand why changing the charter of savings associations would change the activities of the savings associations.

3. There were, of course, many causes of the 1980s S&L crisis, and there are literally hundreds of publications about it. Some of the better ones are Barth (1991), Kane (1989), National Commission (1993), and White (1991).

4. See Blinder and Stiglitz (1983).

characteristics and the other with nontraditional risk characteristics. Both types of borrowers have housing values as part of their Cobb-Douglas utility functions, as used by Stein (1995), and both are constrained by their budgets or:

$$(1)\qquad U = \alpha_i \ln V_i + (1-\alpha_i)\ln F_i - \theta\,(r_M^D M_i + pF_i - I_i - r_f(S_i - D_i)),$$

where V is the house price, F is the quantity demanded of other goods (called food), r_M^D is the rate demanded by borrowers for mortgage credit, M is the amount of mortgage credit demanded, p is the price of food, I is the borrower's income, r_f is the risk-free interest rate, which here is the opportunity cost of the down payment, S is the borrower's savings, D is the down payment on the mortgage, α is a parameter of the utility function, θ the marginal utility of income, and the subscript i denotes the type of borrower (which will be indicated only when needed for clarity). By definition, $V=M+D$, and we assume that the mortgage rate is higher than the risk-free interest rate and that the borrower is certain about his or her income. Thus, the borrower uses all savings for the down payment, or $S=D$. The borrower chooses the value of the house and the quantity of goods he or she wishes to consume, yielding the first-order conditions:

$$(2)\qquad \begin{aligned} &\partial U/\partial V = \alpha/V - \theta r_M^D = 0 \\ &\partial U/\partial F = (1-\alpha)/F - \theta p = 0 \\ &I = r_M^D(V-S) + pF. \end{aligned}$$

By solving for the marginal rate of substitution between the value of the house and food, and using the income constraint, we find the mortgage amount desired by the borrower:

$$(3)\qquad M = \frac{\alpha(I + r_M^D S)}{r_M^D} - S.$$

The Traditional Mortgage Lender

We assume that financial institutions minimize the variance of a portfolio for any given level of expected return and then integrate this standard model of asset allocation with the supply and demand conditions in the mortgage markets. First, consider a traditional mortgage lender, who holds two types of assets—Treasury securities and traditional mortgages. By traditional mortgages, we mean mortgages that meet well-understood and standardized underwriting criteria. The technology for creating such a firm—one that underwrites conventional, conforming mortgages—is readily available.

The traditional mortgage lender's expected return on a traditional mortgage is:

$$(4)\qquad \mu_c = [r_M(1-d_c) + d_c l_c - \chi_c - r_f]$$

where d_c is the probability of default for a traditional borrower, l_c is the loss rate on a defaulted traditional mortgage ($l_c < 0$), and χ_c is the cost of underwriting a traditional borrower. Since the traditional mortgage lender can invest in Treasury securities as well, the expected return on the portfolio of this type of institution is:

$$(5)\qquad \psi_c = x_c\mu_c + x_t r_f,$$

where x_c and x_t (which here equals $1\text{–}x_c$) are the proportions of traditional mortgages and Treasury securities held in portfolio.

The variance in return on a traditional mortgage (the institution holds assets until maturity, so there is no variance in the return on Treasury securities) is:

$$(6)\qquad v_c = (r_M - l_c)^2 d_c(1-d_c),$$

and the traditional mortgage lender solves the problem:

$$(7)\qquad \prod_c = \text{Min}\ x_c^2 v_c \quad \text{s.t.}\ u_p = \psi_c,$$

where μ_p is the firm's target rate of return, and the traditional mortgage lender solves for x_c and x_t.

Solving for x_c, we find:

$$(8)\qquad x_c^* = \frac{\mu_p - r_f}{\mu_c - r_f}.$$

With free entry and exit in the traditional mortgage industry, the target rate of return is driven by competition to equal the expected risk-adjusted return on capital in the economy. We solve for the contractual traditional mortgage rate (r_M) so that:

$$(9)\qquad \mu_c = (\mu_m - r_f)\frac{v_c}{v_m} + r_f,$$

where (μ_m, ν_m) is the accepted risk-return trade-off in the economy (similar to a long-run or equilibrium return to capital).[5]

5. Equation (9) is similar to the equation for a capital market line, but instead of suggesting that an exogenous covariance exists between the market portfolio and the default risk of a mortgage (which we believeis difficult, if not impossible, to define and estimate), we argue that the entry and exit of firms in the market brings about an adjustment in mortgage rates that equates the firms' willingness to take risk with the willingness of investors generally.

Using equation (9), we find r_M* from equation (4), and then solve equation (8) for x_M*, the *equilibrium* proportion of mortgages held by a traditional mortgage lender. The solution is complicated, but can be calculated without difficulty using Mathematica.[6]

The Nontraditional Mortgage Lender

Making nontraditional mortgages requires an "up-front" fixed cost investment by the lender, so that the lender "knows the market." This initial investment makes the lender's market idiosyncratic, partly protecting the nontraditional lender from competitors. Having paid to be a monopolist, the nontraditional lender chooses the nontraditional mortgage rate to maximize total revenues or:

$$\text{(10)} \qquad \text{Max } r_M^n M_n,$$

where r_M^n is the mortgage rate offered by the lender to a nontraditional mortgage borrower, and M_n is the demand for mortgages in the lender's nontraditional market.

Like the traditional lender, the nontraditional lender minimizes the variance of its portfolio subject to its target rate of return. However, the nontraditional lender can invest in Treasury securities and traditional mortgages, as well as nontraditional mortgages, or:

$$\text{(11)} \qquad \prod_n = \text{Min } x_c^2 v_c + x_n^2 v_n \quad \text{s.t.} u_p = \psi_n,$$

where ψ_n is $x_c\mu_c + x_n\mu_n + (1 - x_c - x_n)r_f$, and μ_n is the expected return on a nontraditional mortgage (defined in a manner similar to that for the traditional mortgage).

The nontraditional mortgage lender solves for the proportion of traditional and nontraditional mortgages to hold, subject to the contract mortgage rate in the nontraditional market (determined by equation (10)) and the contract rate in the traditional market (determined by equation (9)). Again, the solution is complicated but easily derived using Mathematica.

III. SIMULATION OF COMPARATIVE STATICS

To illustrate the effect of interest rate and income shocks, we use realistic parameters for our model and graph the effect of changes in interest rates, borrower income, and down payment amount on the proportion of mortgage holdings for each type of lender. For simplicity, we assume that the parameters in the utility functions and the income and savings of traditional and nontraditional mortgage borrowers are the same. We also assume that the covariance between the expected return on traditional and nontraditional mortgages is zero, although it is straightforward to use a given covariance structure. The complete list of parameter assumptions is given in the Appendix.

The cumulative default rate for Freddie Mac mortgages during the 1980s and early 1990s was about 2.16 percent, with default rates ranging from 0.79 to 6.2 percent, depending on the loan-to-value ratio for the mortgage. This range implies annual default rates from under 0.08 percent to as high as 0.6 percent. For FHA loans, the cumulative default rates range from 5 percent to 15 percent, implying annual default rates ranging from 0.5 to 1.5 percent.[7] We will assume that traditional mortgage borrowers default at an annual rate of 0.08 percent and that nontraditional default at 0.50 percent.

For Freddie Mac, losses on a foreclosure run about 40 percent on their typical *conforming* mortgage of roughly $110,000.[8] Losses on FHA mortgages range from 45 to 55 percent. Thus, once a mortgage defaults, there seems to be little variance in the losses incurred as a proportion of the mortgage. We assume that losses on defaults are 40 percent of the loan amount for both traditional and nontraditional borrowers.

Another parameter of interest is the cost of underwriting. We assume that traditional borrowers cost 1 percent of the mortgage amount to underwrite, and nontraditional cost 3 percent. The average cost of mortgage origination in 1989 has been estimated to range from 1 to 2 percent.[9] According to the trade press, total origination costs for the average mortgage in 1994 appear to be somewhat above 2 percent, but this cost involves much more than underwriting.

For the returns on investments, we base parameters on data from 1986 to 1996. In our simulations, we use the return and standard deviation for Treasury bonds for the market's expected risk-return trade-off on a portfolio of mortgages and bills. We use the return on Treasury bills for the bank's cost of funds in those simulations where we vary parameters other than the bank's cost of funds. From 1986 to 1996, Treasury

6. Laderman and Passmore (1998) is an expanded version of this paper, containing the Mathematica code.

7. For Fannie Mae and Freddie Mac delinquency rates, see their 1995 annual reports. For Freddie Mac's cumulative default rate and losses on foreclosure, see R. Van Order and P. Zorn (1995). For FHA default rates, see Berkovec, et al. (1998). For an analysis which includes a comparison of the default and loss rates of these institutions see G. Canner, W. Passmore, and B. Surette (1996).

8. However, if mortgage payments are brought up to date through either a loan modification or a home sale prior to foreclosure, the losses may fall to a range of 6 percent to 22 percent. See "Examining Secondary Market Trends," *America's Community Banker,* April 1996.

9. See Passmore (1992).

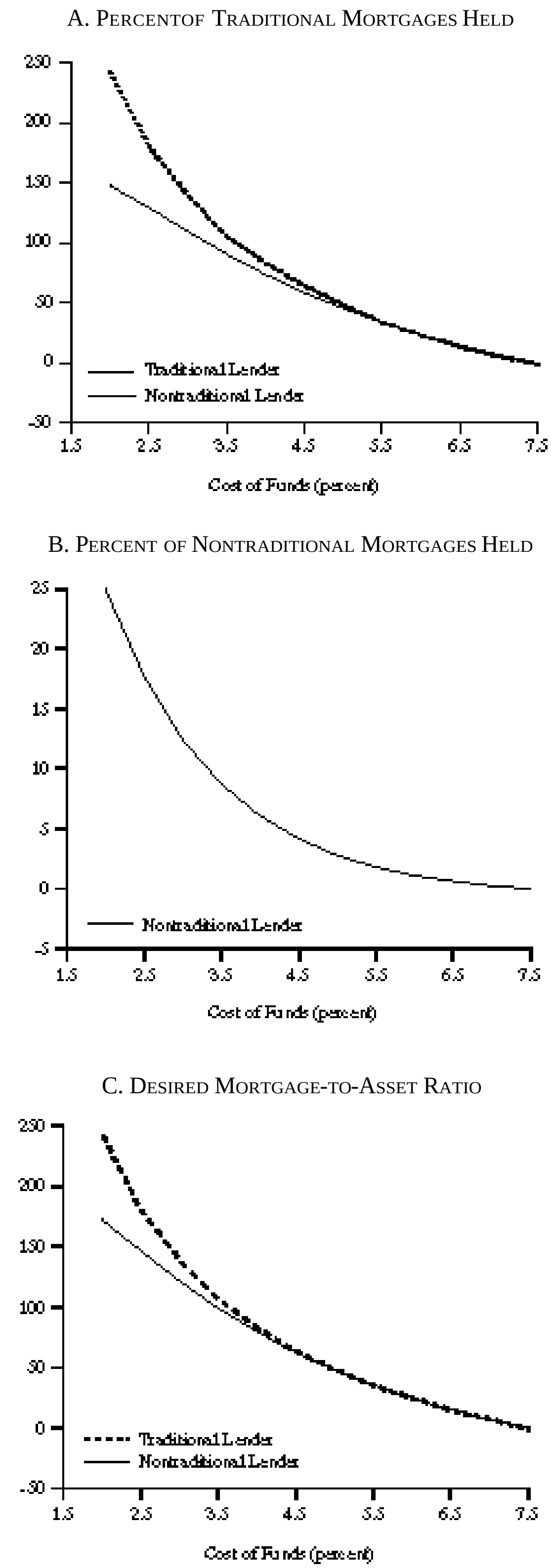
bonds yielded 7.5 percent, with a standard deviation of 1 percent, while Treasury bills yielded 6.01 percent.[10]

We first examine the effect on the proportion of mortgages held by traditional and nontraditional lenders of a change in their cost of funds. The yield paid for their funds is r_f, the yield paid on the risk-free investment alternative available to the lenders. As the depository's cost of funds increases with interest rates, the proportion of total mortgages held in lenders' portfolios declines because the relative attractiveness of Treasury securities rises (top panel, Figure 1). The traditional lender contracts its share of traditional mortgages (the only type of mortgages it holds) more quickly than the nontraditional lender because the marginal profit on a traditional mortgage, while falling rapidly compared to a Treasury security, is not falling as rapidly as the marginal profitability of a nontraditional mortgage. Thus, the traditional-only lender is substituting Treasuries for traditional mortgages, while the nontraditional lender is substituting Treasuries for both traditional and nontraditional mortgages, and also is substituting traditional for nontraditional mortgages. As shown in the middle panel of Figure 1, the proportion of nontraditional mortgages held by the nontraditional lender falls rapidly as rates rise.[11]

When examining the mortgage-to-asset ratio (bottom panel of Figure 1), which will be the variable of interest in the empirical work that follows, the traditional lender contracts more rapidly than the nontraditional lender at lower levels of interest rates, but the contraction by these lenders becomes almost identical at higher levels of interest rates. These representative simulations suggest that changes in mortgage-to-asset ratios of lenders in response to interest rate shocks are unlikely to differ much by type of lender.[12]

FIGURE 1

The Effect of Interest Rate Shocks on Mortgage Holdings



10. We also conducted simulations using return parameters based on long-run historical data from 1926 to 1991. (See Laderman and Passmore 1998.) These simulations showed responses that were qualitatively similar to the simulations based on the more recent data.

11. Note that the level of the nontraditional mortgage-to-asset ratio is usually very small relative to the level for the traditional mortgage-to-asset ratio. There is little empirical evidence about the level of nontraditional mortgages. For a brief time, the OTS collected information from savings associations on the amount of mortgages they made with greater than 80 percent loan-to-value ratios and with no private mortgage insurance. This type of mortgage often is extended to nontraditional borrowers. Many of the institutions had less than 5 percent of their mortgages in this category.

12. Note that the desired amount of mortgages can be negative or can exceed 100 percent, depending on their relative return. If the institution has the ability to "short" mortgage securities or Treasury securities, it might pursue these strategies. Otherwise, we could assume the mortgage-to-asset ratio is capped at zero or 100 percent. For the discussion of the comparative statics, this makes no difference.

Similarly, changes in the expected return on a market portfolio (Figure 2) are very similar for lenders with high or low proportions of nontraditional mortgages in their portfolios. In addition, these changes affect the proportion of mortgages of all lenders in a linear and direct fashion, with increases as the expected return on the portfolio increases (holding risk—which results only from holding mortgages—constant) resulting in larger relative holdings of mortgages.

Income shocks have very different effects on traditional and nontraditional lenders (Figure 3). In our model, traditional mortgages are provided by a classic, atomistic group of suppliers. Changes in the level of income of traditional mortgage borrowers result in changes in the overall size of the traditional mortgage market, but do not result in changes in the relative proportion of assets allocated to mortgages by traditional lenders (top panel, Figure 3). In contrast, nontraditional mortgages are provided by lenders who "know their community" and see the downward slope of the community's demand curve. Thus, an increase in these borrowers' incomes raises the profitability of providing mortgages to these borrowers, causing the ratio of nontraditional mortgages to assets to rise (middle panel, Figure 3) and the ratio of traditional mortgages to assets to fall at nontraditional lenders (top panel, Figure 3).

As shown in the bottom panel, the fall in traditional mortgages can exceed the rise in nontraditional mortgages at nontraditional lenders, with the result that a positive income shock has a negative effect on the mortgage-to-asset ratio at nontraditional lenders. (But a nonnegative relationship between income and the mortgage-to-asset ratio, or one that is only slightly different from that experienced by traditional lenders, is also possible.) As will be seen below, the possibility of a non-zero response is a key distinction in our effort to separate lenders who provide a commodity-like mortgage product from those who serve markets with nontraditional borrowers.

Similarly, changes in house prices (which, in our model, are equal to changes in down payment requirements) have different effects on traditional and nontraditional lenders (Figure 4). Higher home prices (or higher down payment requirements) cause consumer demand for mortgages to contract. The effects are equivalent to a negative income shock, with the marginal profitability of nontraditional mortgages falling as housing prices or down payment requirements rise, and lenders then contracting the proportion of nontraditional mortgages in their portfolios (middle panel). However, overall mortgage-to-asset ratios at nontraditional lenders rise, as relatively more traditional mortgages (with their small marginal profits) are added to compensate for the decline (bottom panel). Traditional lenders, who do not see consumer demand in their

FIGURE 2

THE EFFECT OF MARKET PORTFOLIO RETURN ON MORTGAGE HOLDINGS

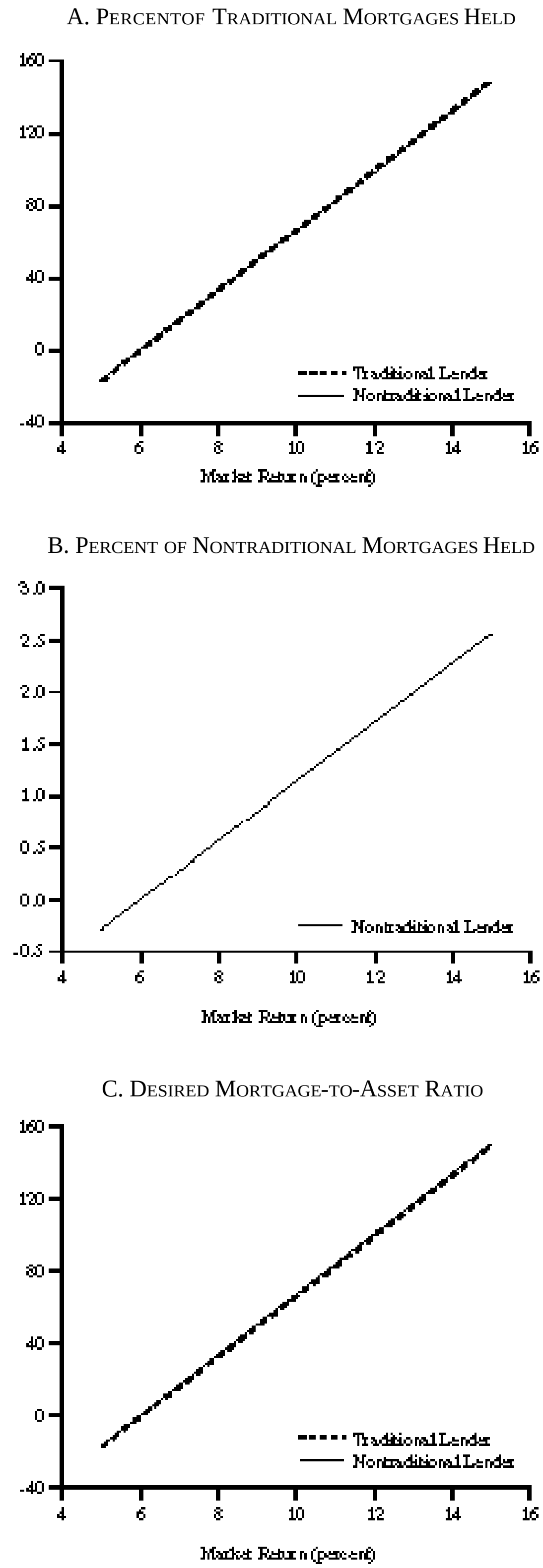
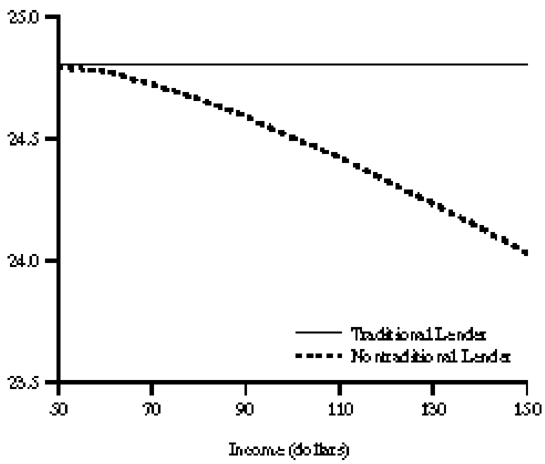


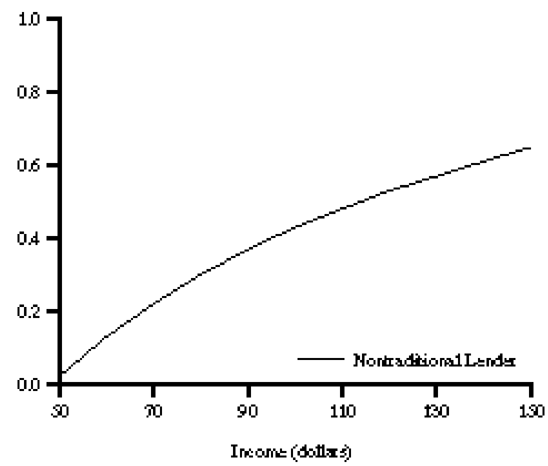
FIGURE 3

THE EFFECT OF INCOME SHOCKS ON MORTGAGE HOLDINGS

A. PERCENT OF TRADITIONAL MORTGAGES HELD



B. PERCENT OF NONTRADITIONAL MORTGAGES HELD



C. DESIRED MORTGAGE-TO-ASSET RATIO

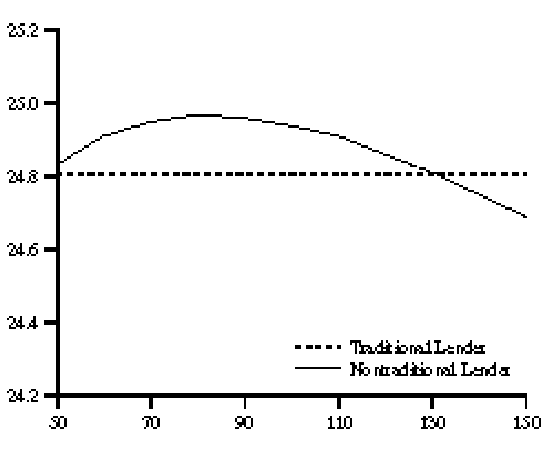
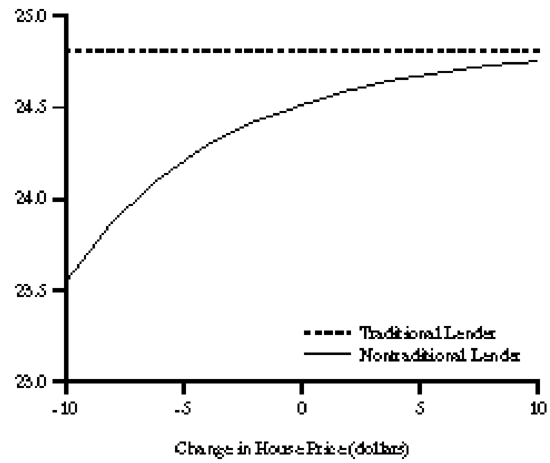


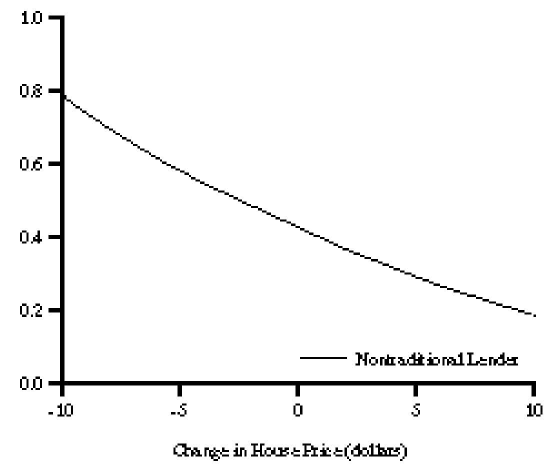
FIGURE 4

THE EFFECT OF HOUSE PRICE ON MORTGAGE HOLDINGS

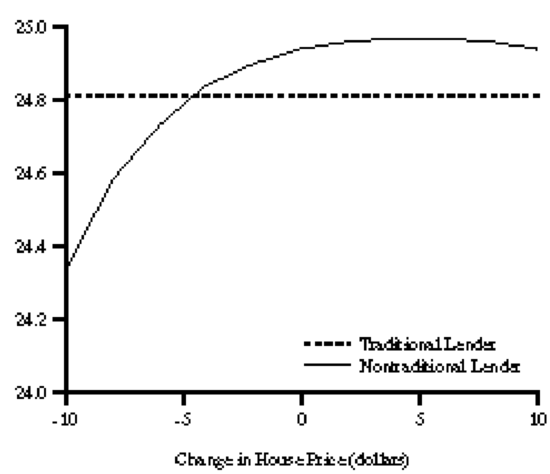
A. PERCENT OF TRADITIONAL MORTGAGES HELD



B. PERCENT OF NONTRADITIONAL MORTGAGES HELD



C. DESIRED MORTGAGE-TO-ASSET RATIO



objective functions, do not change the relative proportions of their portfolios.

Finally, we calculated the mortgage rates implied by our model (Figure 5). Traditional mortgage rates vary with interest rates and span a reasonable range of values. Nontraditional mortgage rates are set at the revenue-maximizing level and are not influenced by other interest rates. Generally, the nontraditional rate derived from our simulations is higher than the traditional rate.

IV. A Regression Analysis of Bank and Savings Association Lending Behavior

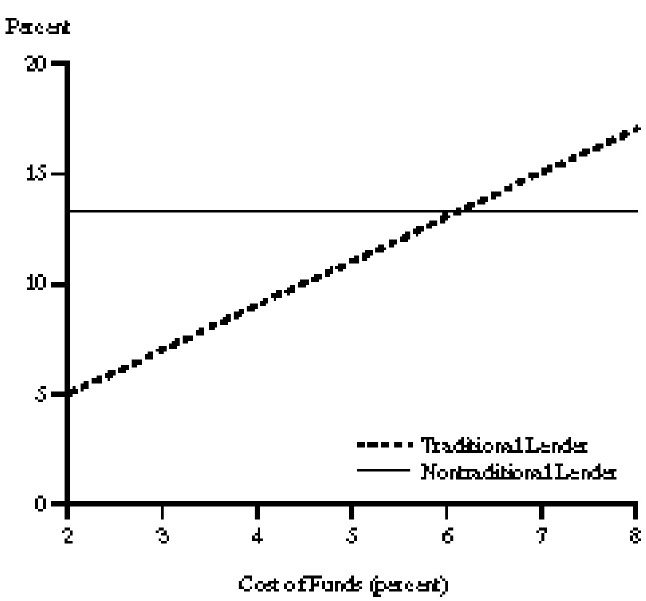
To test our theory and to describe the differences in lending behavior between commercial banks and savings associations, we develop a regression model based on the theory presented earlier. Our theory suggests that interest rates have a negative and nonlinear effect on the mortgage-to-asset ratio at both traditional and nontraditional lenders, while the market return has a positive and linear effect. For nontraditional lenders, both the income of borrowers and house prices can affect the mortgage-to-asset ratio, but for traditional lenders, income and house prices have no effect.

Let m_t be the mortgage-to-asset ratio, and assume that the depository institution desires to move this ratio to a ratio of m_t*. We assume a partial-adjustment process:

$$m_t = m_{t-1} + k(m_t^* - m_{t-1}), \tag{12}$$

FIGURE 5

MORTGAGE RATES



where t is a time subscript. The optimal mortgage-to-asset ratio, m_t*, is modeled as a function of interest rates, market returns, borrower incomes, house prices, and delinquency rates, as well as control variables for the region of the country and the size class of the institution.

The Linear Model

Despite the nonlinear nature of our theoretical model, our first regression has a simple linear specification. This regression provides us with initial values for the parameters in the nonlinear regression estimation, as well as a check on the robustness of other results. The linear model for the optimal mortgage-to-asset ratio is:

$$\begin{aligned} m_t^* = {} & c + \alpha r_{f_t} + \beta I_t + \gamma V_t + \lambda \mu_{m_t} \\ & + \theta_1 NE + \theta_2 S + \theta_3 MW + \theta_4 LARGE \\ & + \theta_5 MED + \theta_6 MNPDNA. \end{aligned} \tag{13}$$

In our empirical work, we use the one-year Treasury bill interest rate for r_f, real average hourly earnings in the state in which the institution is located for I, the weighted average real value of median house prices in the state in which the institution is located for V, and the 10-year Treasury bond interest rate for μ_m.[13] *MNPDNA* is the long-run average of the ratio of the institution's past-due and nonaccruing mortgage loans to total mortgage loans, measured in percent.[14] The interest rates are measured in percent, as is the dependent variable in the regression. Real average hourly earnings are in dollars. The house price is in thousands of dollars.

13. The house price variable was constructed in several steps. First, median house prices for 1987 were obtained from the National Association of Realtors. These data are in thousands of nominal dollars and are available by Metropolitan Statistical Area (MSA). Next, MSA data were aggregated to the state level using population weights. Then, for each state, a time series of house prices was generated by multiplying the 1987 house price by a time series of repeat sales house price indices for that state. The house price index is normalized to be 100 in every state in 1987, so the resulting house price time series was divided by 100 to yield a time series of nominal house prices, in thousands of dollars. Nominal house prices were then converted into real house prices using the Consumer Price Index.

14. The past due and nonaccruing ratio was taken as the sum of mortgage loans past due 90 days or more plus nonaccruing mortgage loans, divided by total mortgage loans. The long-run average was taken over the years in the sample period for which data were available: 1990.Q1–1996.Q4 for savings associations and 1991.Q1–1995.Q3 for commercial banks.

The control variables *NE, S*, and *MW* are dummy variables, with values of 1 indicating that the institution is in the Census-defined Northeast, South, or Midwest, respectively. (The West is the omitted category.) The variable *LARGE* takes a value of 1 if the institution has total assets greater than or equal to $1 billion as of the third quarter of 1988, and the variable *MED* takes a value of 1 if the institution has total assets greater than or equal to $500 million, but less than $1 billion, as of the same date.

Our data are quarterly and cover the period from the third quarter of 1988 to the fourth quarter of 1996.[15] We screened our sample to include only institutions that existed throughout the sample period and that were well-capitalized as of the third quarter of 1988. We also excluded savings associations with unusually high (≥85 percent) or unusually low (≤10 percent) mortgage-to-assets ratios in any quarter of the sample.[16] We applied the same screens to commercial banks that we applied to savings associations. After applying these screens, we had 3,230 banks and 693 savings associations in our sample.

Figure 6 presents the time series of the cross-sectional means of the dependent variable for commercial banks and saving associations. Savings associations do much more residential mortgage lending than commercial banks; the mean mortgage-to-asset ratio over our savings association sample ranges from 48.8 percent to 54.8 percent, whereas for banks it ranges from 20.4 percent to 24.2 percent. Also, savings associations responded to the credit crunch of the early 1990s by cutting back mortgage lending sharply, while banks increased their mortgage lending at a steady pace. Table 1 presents sample statistics for the regression variables.

15. Since the regression includes the lagged dependent variable on the right-hand side, the first observation for the dependent variable is in the fourth quarter of 1988.

16. In addition, we use only savings associations whose regulator—the OTS—is separate from the regulators of commercial banks.

Model Estimation and Results

Inserting equation (12) into equation (13) and dropping the t subscripts on r_f, I, V, and μ_m, we estimate the following regression equation:

$$(14)\qquad \begin{aligned} m_t = {} & (1-k)m_{t-1} + kc + k\alpha r_f \\ & + k\beta I + k\gamma V + k\lambda\mu_m + k\theta_1 NE \\ & + k\theta_2 S + k\theta_3 MW + k\theta_4 LARGE \\ & + k\theta_5 MED + k\theta_6 MNPDNA + \varepsilon, \end{aligned}$$

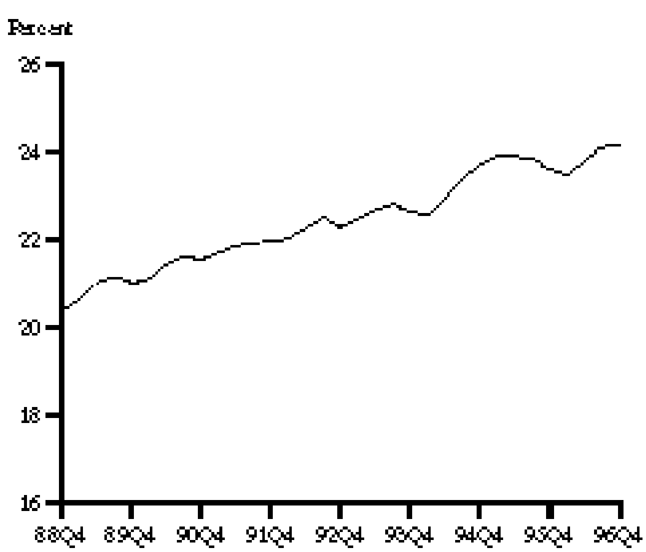
where ε is a normally distributed error term.

The regression results are presented in the second and third columns of Table 2. Except for m_{t-1}, we present only the long-run coefficients, which affect the desired mortgage-to-asset ratio. The results suggest that the banks behave as predicted by the theoretical model: the long-run

FIGURE 6

MEAN OF THE MORTGAGE-TO-ASSET RATIO

A. COMMERCIAL BANKS



B. SAVINGS ASSOCIATIONS

TABLE 1

SAMPLE STATISTICS FOR REGRESSION VARIABLES
COMMERCIAL BANKS

VARIABLE	MEAN	MEDIAN	MINIMUM	MAXIMUM	S.D.
m_t	22.44	20.77	10	80.89	8.21
r_f	5.89	5.64	3.18	9.57	1.77
I	2.76	2.79	2.02	3.75	0.31
V	29.15	28.05	13.83	83.98	7.04
μ_m	7.26	7.2	5.36	9.36	1.05
NE	0.1	0	0	1	0.29
S	0.39	0	0	1	0.49
MW	0.47	0	0	1	0.5
LARGE	0.005	0	0	1	0.07
MED	0.009	0	0	1	0.09
MNPDNA	0.91	0.64	0	11.93	0.95

SAVINGS ASSOCIATIONS

VARIABLE	MEAN	MEDIAN	MINIMUM	MAXIMUM	S.D.
m_t	51.79	52.63	10.37	84.81	51.41
r_f	5.89	5.64	3.18	9.57	1.77
I	2.82	2.83	2.02	3.75	0.3
V	31.05	28.5	13.83	83.98	8.96
μ_m	7.26	7.2	5.36	9.36	1.05
NE	0.2	0	0	0.1	0.4
S	0.32	0	0	0.1	0.47
MW	0.4	0	0	0.1	0.49
LARGE	0.03	0	0	0.1	0.16
MED	0.04	0	0	0.1	0.18
MNPDNA	1.26	0.83	0	17.34	1.43

coefficient on the risk-free rate is negative and significant, and the coefficient on the market return is positive and significant. In contrast, for savings associations, the coefficient on the risk-free rate is positive and significant, while the coefficient on the market return is negative and significant.[17]

The estimation also indicates that there is no statistically significant difference between how banks' and savings associations' mortgage-to-asset ratios respond to changes in income or changes in house prices. We calculated 90 percent confidence intervals for the estimates of the long-run coefficients on income and house prices for the two types of institutions and found that they overlapped.

To check our results that the responses of the mortgage-to-asset ratio to changes in income and the home price at banks and savings associations are not significantly

17. Both the risk-free interest rate and the 10-year Treasury bond rate were on a declining trend from the end of 1988 to about the end of 1993, and then turned up for about a year before leveling off.

TABLE 2

LINEAR REGRESSION RESULTS FOR MORTGAGE-TO-ASSET RATIO: FULL SAMPLE

EXPLANATORY VARIABLE	COMMERCIAL BANKS (98,408 OBSERVATIONS, ADJUSTED R^2=0.96)	SAVINGS ASSOCIATIONS (21,177 OBSERVATIONS, ADJUSTED R^2=0.974)	
		UNCONSTRAINED REGRESSION	CONSTRAINED REGRESSION
m_{t-1}	0.981*** (0.001)	0.985*** (0.001)	0.985*** (0.001)
constant	-0.993 (4.45)	43.8*** (16.9)	-7.03 (16.2)
r_f	-1.11*** (0.302)	9.64*** (1.41)	0 (0)
I	4.35*** (1.15)	1.17 (4.82)	2.14 (4.87)
V	0.142*** (0.043)	-0.23 (0.161)	-0.169 (0.162)
μ_m	3.91*** (0.537)	-6.21*** (2.14)	7.85*** (1.2)
NE	8.87*** (1.63)	-8.91* (5.09)	-8.78* (5.14)
S	1.26 (1.49)	-1.56 (5.04)	-0.737 (5.09)
MW	1.79 (1.45)	-0.168 (5.21)	0.396 (5.27)
LARGE	-3.78 (4.09)	6.68 (7.38)	0.617 (7.45)
MED	-5.14* (3.02)	-6.93 (6.24)	-7.04 (6.31)
MNPDNA	-3.0*** (0.317)	-2.42*** (0.887)	-2.49*** (0.898)

NOTE: Except for m_{t-1}, reported numbers are partial derivatives of m^*; standard errors are in parentheses.
* (***) statistically significant at the 10 (1) percent level

different, we also estimate the linear model with our theoretical constraints imposed on the long-run coefficients for the risk-free rate and the market return in the savings association regression. Specifically, we restrict the coefficient on the risk-free rate to be less than or equal to zero and the coefficient on the market return to be greater than or equal to zero.

Imposing the constraints on the estimation of the risk-free rate and market return coefficients results in a zero coefficient for the risk-free rate and a positive and significant coefficient for the market return for savings associations (last column). These results are more consistent with the simulations of the theoretical model than were the unconstrained regression results for savings associations.

As in the unconstrained regression, the savings associations' long-run income and home price coefficients are not significantly different from those of banks. Based on these results, one cannot say that savings associations behave more like the theoretically modeled nontraditional lender than do commercial banks. However, two considerations cloud the interpretation of this result. First, our model suggests that the partial derivative of the mortgage-to-asset ratio with respect to home prices is dependent on the levels of other variables. Second, the unconstrained savings associations' results depart from the predictions of the theoretical model about how the mortgage-to-asset ratio is affected by the risk-free interest rate and the market return. We can correct for the first problem by turning to a nonlinear model.

The Nonlinear Model

The basic nonlinear model for the desired mortgage-to-asset ratio is:

$$m_t^* = \delta r_f^{\alpha} I^{\beta_0} V^{\gamma_0} + \beta_1 I + \gamma_1 V + \lambda \mu_m + \theta_1 NE + \theta_2 S + \theta_3 MW + \theta_4 LARGE + \theta_5 MED + \theta_6 MNPDNA. \quad (15)$$

The form of equation (15) was suggested by three features of the simulation results shown in Figures 1–4. First, the partial derivatives of the mortgage-to-asset ratio with respect to the risk-free interest rate, income, and the value of the house can be nonlinear, while the partial derivative with respect to the market return is linear for both traditional and nontraditional lenders. Second, the shapes of the partial derivatives of nontraditional lenders' mortgage-to-asset ratios with respect to the risk-free rate, income, and house price depend on the other variables. Third, the simulation results show that the partial derivatives of nontraditional lenders' mortgage-to-asset ratios with respect to income and home price may be concave. Including the parameter and the linear income and home price terms permits enough flexibility in the functional form so that the partial derivatives of the mortgage-to-asset ratio with respect to income and home price can be concave.

Inserting equation (12) into equation (15), we attempted to estimate the following nonlinear equation[18]:

$$m_t = (1-k)m_{t-1} + k\delta r_f^{\alpha} I^{\beta_0} V^{\gamma_0} + k\beta_1 I + k\gamma_1 V + k\lambda\mu_m + k\theta_1 NE + k\theta_2 S + k\theta_3 MW + k\theta_4 LARGE + k\theta_5 MED + k\theta_6 MNPDNA + \varepsilon. \quad (16)$$

The estimation of this model converged for savings associations but not for banks, so we simplified the specification to exclude the linear terms in income and home price. This restricts the partial derivatives with respect to income and home price to be either positive or negative throughout (with the slope either decreasing or increasing throughout), constant, or zero. Note that this excludes the possibility of a positive and decreasing slope turning to a negative and decreasing slope as income or home price increases. In other words, it excludes the possibility of a concave shape for the derivative.[19]

18. In order to do the nonlinear estimation, we had to provide initial values for each of the parameters. Setting δ=1 and $\beta_1=\gamma_1=0$, and using sample means for the explanatory variables, we assigned initial parameter values so as to equate the value of each of the partial derivatives in the nonlinear regression with the corresponding partial derivative in the corresponding (bank or savings association) unconstrained linear regression.

19. We also attempted to estimate the following equation:

$$= \delta(\alpha_0 r_{f_t})^{\alpha_1}(\beta_0 I_t)^{\beta_1}(\gamma_0 V_t)^{\gamma_1} + \beta_2 I_t + \lambda\mu_m + \theta_1 NE + \theta_2 S + \theta_3 MW + \theta_4 LARGE + \theta_5 MED + \theta_6 MNPDNA.$$

The estimation converged for savings associations, but not for banks.

TABLE 3

NONLINEAR REGRESSION RESULTS FOR MORTGAGE-TO-ASSET RATIO: FULL SAMPLE

EXPLANATORY VARIABLE	COMMERCIAL BANKS (98,408 OBSERVATIONS, ADJUSTED R^2=0.96)	SAVINGS ASSOCIATIONS (21,177 OBSERVATIONS, ADJUSTED R^2=0.974)
m_{t-1}	0.981***	0.985***
	(0.001)	(0.001)
r_f	-0.629***	9.13***
	(0.009)	**(0.0001)**
I	0.986*	-1.23
	(0.055)	**(0.794)**
V	0.038*	-0.06
	(0.07)	**(0.735)**
μ_m	4.03***	-4.98**
	(0.202)	(2.08)
NE	9.1***	-7.17
	(1.53)	(5.06)
S	2.26*	0.802
	(1.28)	(4.95)
MW	3.62***	3.67
	(1.28)	(5.05)
LARGE	-4.15	5.89
	(4.07)	(7.42)
MED	-4.88	-7.53
	(3.0)	(6.3)
MNPDNA	-2.99***	-2.48***
	(0.315)	(0.898)

NOTE: Except for m_{t-1}, reported numbers are partial derivatives of m^*; standard errors are in unbolded parentheses; significance levels are in bold parentheses.

* (**) (***) statistically significant at the 10 (5) (1) percent level

The simplified regression model then is:

$$(17)\quad m_t = (1-k)m_{t-1} + k\delta r_f^{\alpha} I^{\beta} V^{\gamma} + k\lambda\mu_m + k\theta_1 NE + k\theta_2 S + k\theta_3 MW + k\theta_4 LARGE + k\theta_5 MED + k\theta_6 MNPDNA + \varepsilon.$$

The estimation of equation (17) converged for both banks and savings associations (Table 3). Again, except for m_{t-1}, we report only the partial derivatives of the optimal mortgage-to-asset ratio with respect to each of the variables. For both banks and savings associations, we evaluate these partial derivatives at the pooled sample (banks and savings associations together) means for the explanatory variables. Using the same values for the relevant explanatory variables to calculate the partial derivatives that depend on these variables in the bank and savings association regressions ensures that any differences in these partial derivatives are due to factors other than differences in the underlying variables.

As in the linear regressions, there is no statistically significant difference between banks and savings associations in the estimated partial derivatives of their mortgage-to-asset ratios with respect to income or the house price.[20]

20. We attempted to estimate equation (17) with constraints imposed in the savings associations regression on the signs of the partial derivatives of the mortgage-to-assets ratio with respect to the risk-free interest rate and the market return, but the estimation did not converge.

High Mortgage-Ratio Banks

The regression results so far suggest that there is no difference between banks and savings associations in terms of their responses to shifts in the demand-side variables. Yet these results were derived assuming that our model adequately describes the behavior of commercial banks and

FIGURE 7

Mean of the Mortgage-to-Asset Ratio for High Mortgage Ratio Banks

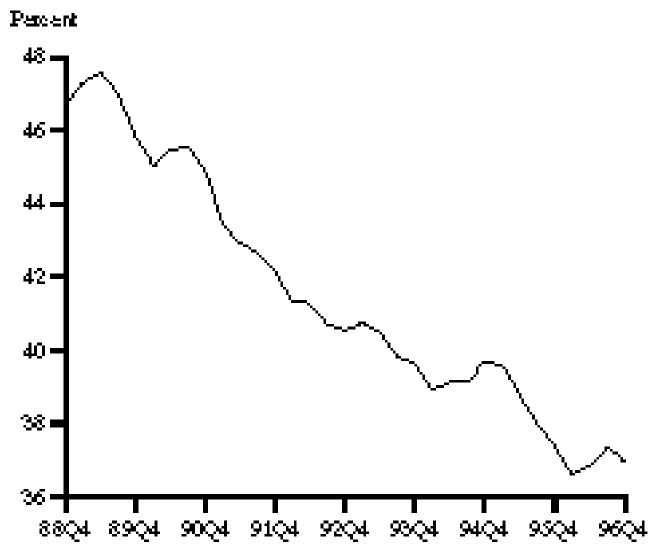


TABLE 4

Sample Statistics for Regression Variables for High Mortgage Ratio Banks

Variable	Mean	Median	Minimum	Maximum	S.D.
m_t	41.51	42.43	7.44	80.89	11.08
r_f	5.89	5.64	3.18	9.57	1.77
I	2.79	2.81	2.02	3.75	0.31
V	32.87	30	13.83	67.54	8.56
μ_m	7.26	7.2	5.36	9.36	1.05
NE	0.33	0	0	1	0.47
S	0.34	0	0	1	0.47
MW	0.26	0	0	1	0.44
LARGE	0	0	0	0	0
MED	0	0	0	0	0
MNPDNA	1.15	0.88	0.03	5.54	1.01

savings associations. Empirically, commercial banks seem to conform to our model, whereas savings associations do not, suggesting that our model may not correctly capture the behavior of depository institutions that specialize in mortgage lending.

By selecting a group of banks that specialize in mortgage lending, we can extend our comparison of mortgage-lending behavior and, in the process, determine if our model of a depository institution is adequately capturing the response of mortgage-oriented lenders. We create a set of mortgage-oriented banks—those with a mortgage-to-asset ratio of at least 40 percent as of the third quarter of 1988. This cutoff results in only 80 banks in the sample, highlighting the strong differences in the degree of specialization in mortgages by banks and savings associations. Mortgage-oriented banks show a mean mortgage-to-asset ratio that declines in a fashion similar to the mean savings association mortgage ratio suggesting that these commercial banks undertake mortgage adjustments in a manner similar to savings associations (Figure 7).

To test this theory, we estimate equation (14) for the high mortgage ratio banks. Table 4 shows the sample statistics. (Note that all of the high mortgage ratio banks are small.) The results are reported in Table 5. The results for high mortgage ratio banks' long-run responses to changes in the home price or changes in income are not statistically significantly different from the unconstrained or constrained results for savings associations. This provides further support to the hypothesis that the savings association charter does not give savings associations special market power in mortgage lending, as compared with commercial banks.

We also estimate the nonlinear equation (17) for the high mortgage ratio banks. These results again suggest that there is no difference between high mortgage ratio banks and savings associations in terms of their responses to shifts in home price or borrower income. Finally, the negative coefficients on the interest rate and the positive coefficients on the market return in Table 5 suggest that our model does capture the behavior of depository institutions that specialize in mortgage lending.

V. CONCLUSION

This paper presents a theoretical model of lender portfolio choice between home mortgages and an alternative investment in a government security. A distinction is made between traditional lenders, who are price takers in the mortgage market, and nontraditional lenders, who invest in information in order to obtain some market power in a nontraditional mortgage market. Traditional lenders may allocate assets between government securities and mortgages to traditional borrowers, whereas nontraditional lenders may allocate assets between government securities, mortgages to traditional borrowers, and mortgages to nontraditional borrowers (those about whom the nontraditional lender has some special knowledge).

Using realistic parameter values, the comparative statics of the model are simulated, providing information on the signs and relative sizes of the partial derivatives of total mortgages with respect to the model's variables. The simulation results highlight that the traditional lender's port-

TABLE 5

REGRESSION RESULTS FOR MORTGAGE-TO-ASSETS RATIO: HIGH MORTGAGE RATIO BANKS

EXPLANATORY VARIABLE	LINEAR REGRESSION (2,478 OBSERVATIONS, ADJUSTED R^2=0.923)	NONLINEAR REGRESSION (2,478 OBSERVATIONS, ADJUSTED R^2=0.923)
m_{t-1}	0.963*** (0.006)	0.963*** (0.006)
constant	-39.4* (22.9)	—
r_f	-0.232 (1.76)	-0.232 **(0.601)**
I	17.4** (6.75)	6.48 **(0.459)**
V	-0.505** (0.235)	-0.147 **(0.429)**
μ_m	4.95 (3.02)	3.45*** (0.78)
NE	13.5* (7.12)	13.49** (6.82)
S	16.5** (6.9)	14.66** (6.28)
MW	3.69 (7.65)	3.54 (7.13)
LARGE	—	—
MED	—	—
MNPDNA	-4.54** (1.91)	-4.61** (1.92)

NOTE: Except for m_{t-1}, reported numbers are partial derivatives of m^*; standard errors are in unbolded parentheses; significance levels are in bold parentheses.

** (***) statistically significant at the 5 (1) percent level folio choice is independent of changes in demand-side variables, whereas the nontraditional lender's is not.

The model is then estimated using data for commercial banks and savings associations to determine whether savings associations are "special," that is, whether they behave more like nontraditional lenders than do commercial banks. For a large panel of banks and savings associations, the regression results suggest that savings associations are no more sensitive to changes in borrower income or home prices than are banks. However, we have concerns about how well our model describes the behaviors of savings associations, and therefore we also estimated the model using a sample of high mortgage ratio banks. Our results for high mortgage ratio banks imply that our model is not inappropriate for mortgage-oriented depository institutions, as well as confirming that savings associations do not behave more like nontraditional lenders than do banks. Therefore, it appears that the savings association charter could be eliminated without impairing lending to nontraditional mortgage borrowers.

APPENDIX: PARAMETER VALUES USED IN SIMULATIONS

PARAMETER	SIMULATION VALUE
Annual Default Rate on Conforming Mortgage	0.08 percent
Annual Default Rate on Nonconforming Mortgage	0.5 percent
Cost of Underwriting a Conforming Mortgage	1 percent
Cost of Underwriting a Nonconforming Mortgage	3 percent
Loss Rate on Both Conforming and Nonconforming Defaulted Mortgages	40 percent
Mean Return on Market Portfolio	7.5 percent
Variance on Market Portfolio	0.01 percent
Return on Short-Term Treasury Bills	6.01 percent
Income of Conforming and Nonconforming Borrowers	$100
Price of Non-housing Goods	$1
Down Payment Requirement on Both Conforming and Nonconforming Mortgages	$20
Relative Preference for Housing versus Other Goods for Both Conforming and Nonconforming Borrowers	0.1

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