NBER WORKING PAPER SERIES

SAVINGS AND LOAN USAGE OF THE AUTHORITY TO INVEST IN CORPORATE DEBT

Patric H. Hendershott

Kevin E. Villani

Working Paper No. 725

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

July 1981

Presented at "Savings and Loan Asset Management Under Deregulation," the Sixth Annual Conference of the Federal Home Loan Bank of San Francisco, December 1980. The research reported here is part of the NBER's research program on Financial Markets and Monetary Economics. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #725
July 1981

Savings and Loan Usage of the Authority to Invest in Corporate Debt

ABSTRACT

This paper examines the portfolio choice of savings and loan associations (SLAs) between mortgages and bonds, first in a certainty world and then under uncertainty. Differences in servicing and transactions costs, in default losses, in tax treatment and in the timing of payments are accounted for in a certain world. SLAs are seen as investing in bonds only if the demand for mortgage funds is sufficiently weak that more profitable SLAs compete away some of the value of their tax preference by bidding down mortgage rates; in this case less profitable SLAs would find corporate debt attractive.

In an uncertain world, mortgages will command a premium over bonds to compensate for the prepayment option extended mortgage borrowers. The appropriate value of this premium depends on uncertainty regarding future interest rates and aversion to this uncertainty. SLAs that view future interest rates as more uncertain than the market does generally, or who are more averse to this uncertainty, will require an options premium greater than that determined in the market. Thus they will find corporate debt to be attractive relative to bonds, even when the demand for mortgage funds is strong and their mortgage tax preference is not competed away.

Patric H. Hendershott
Krannert School of Management
Prudue University
West Lafayette, Indiana 47906

(317) 493-1884

Kevin E. Villani
Department of HUD
Office of Economic Analysis
451 7th Street, S.W.
Washington, D.C. 20410

(202) 755-5980

TABLE OF CONTENTS

The Depository Institutions Deregulation and Monetary Control Act of 1980 caps two decades of occasionally intense efforts to reform the housing finance system.[1] The basic philosophy underlying those efforts and the 1980 Act is that the public interest is best served when individual firms operate in their own self interest with as little interference as possible from the government. One of these interferences has been a prohibition against federally insured savings and loan association investments in consumer loans and corporate debt securities. The 1980 Act authorizes allocation of up to 20 percent of total assets in these investments. The subject of this paper is the likelihood that savings and loans will find it profitable to purchase the second of these assets, corporate debt securities.

Corporate investment powers were first advocated for savings and loans in 1961 by the Commission on Money and Credit. The general rationale offered for greater flexibility in the choice of investments was that the relaxation of binding portfolio restrictions would stimulate economic growth.[2] This recommendation was repeated a decade later in the Report of the Presidential Commission on Financial Structure and Regulation (commonly called the HUNT Commission), which also proposed investment in equity securities, direct real estate, and some forms of direct loans to

---

1/ Our favorite discussion of these efforts and the issues involved is Patric H. Hendershott and Kevin E. Villani, Regulation and Reform of the Housing Finance System, American Enterprise Institute for Public Policy Research, 1977.

2/ Report of the Commission on Money and Credit, Prentice-Hall, 1961, pp. 160-161.

business such as construction loans. The expansion of investment powers was recommended on grounds of increased competition and/or public convenience.3/ Rather than passing legislation to provide greater flexibility, Congress did the reverse in the 1970s. The Home Mortgage Disclosure Act of 1975 and the Community Reinvestment Act of 1978 both require mortgage lenders to consider credit needs of the local community. The latter, in fact, implicitly imposes quotas for local community mortgage investments.

Passage of the Financial Institutions Act of 1975, in part the legislative embodiment of the HUNT Commission recommendations, would have permitted savings and loans to invest up to 10 percent of their assets in high grade corporate bonds. Proponents of this provision argued that savings and loan earnings would be improved, thereby allowing them to compete more effectively with commercial banks for deposit funds. Opponents countered that the provision would reduce the supply of mortgage credit and result in less housing. The most revealing aspect of this debate was the absence of the voice of the savings and loans. While they argued for the ability to make direct real-estate related loans, they never advocated the corporate bond authority.4/ This alone probably provides an excellent clue as to the likely expected usage of this authority.

3/ Report of the Presidential Commission on Financial Structure and Regulation, Washington, GPO, 1971.

4/ U.S. Congress, Senate, Subcommittee on Financial Institutions of the Committee on Banking, Housing and Urban Affairs, the Hearings on the Financial Institution Act of 1975 94th Congress, first session, May 1975, p. 165.

The present paper is divided into two main sections and a summary. The first examines the choice between bonds and mortgages under certainty. The coupon rates on bonds and mortgages are seen as being comparable only after adjusting for differences in servicing and transaction costs, in default losses, in tax treatment and in the timing of payments. The likely market relationship between bond and mortgage rates is then considered in order to determine the likelihood that savings and loans will, in fact, purchase corporate bonds. Section II extends the analysis to an uncertain world and considers the implications of this uncertainty for mortgage coupon rates and the portfolio behavior of both risk-neutral and risk-averse associations.

I. Bond and Mortgage Investments Under Certainty

In a certain world, four factors are relevant to the savings and loan investment choice: mortgage and bond coupon (net of known default) rates, advantages or disadvantages savings and loans may have in underwriting mortgages and bonds, any special tax treatment that is not independent of this choice, and transactions costs of liquidating assets. Each of these factors is considered in turn. For our current purposes, all facets of the investment are assumed to be known in advance with certainty. Thus, the concept of an exante net yield employed below is equivalent to an expost yield where expectations are exactly realized.

A. Comparable Bond and Mortgage Coupon Rates

There is no readily available and generally accepted method for calculating comparable yields. Even quoted mortgage and bond coupon rates on par value securities of identical default risk are not comparable

owing to differences in the timing of coupon payments and expected principal repayments and in the cost of collecting these payments. Bonds promise a single principal payment at maturity, while mortgage principal is repaid according to an agreed upon amortization schedule. In addition, the remaining mortgage principal may be repaid at any time at the borrower's option. In an earlier paper, we showed that unless interest rates are expected to remain constant comparisons are only possible for securities with the same expected cash flow because unequal flows would be reinvested at different rates.5/ As a first step in making bond and mortgage coupon rates comparable, we specify the alternative to the purchase of a mortgage to be the purchase of a portfolio of bonds with expected principal repayments identical to those expected on a mortgage. Thus the correct bond rate to compare to the mortgage rate is an appropriately weighted average of coupons on bonds of varying maturity. Given a continuous and nonflat yield curve, there is a single maturity bond with a coupon equal to this weighted average. It is this particular coupon that underlies our yield comparisons below. In general, this single maturity depends on interest rate expectations at the time the mortgage is originated.

The mortgages not only repay principal on a different schedule than bonds but interest as well. Annual bond coupon rates (BCoup) are stated

---

5/ "Termination Rates, Interest Rate Uncertainty and Mortgage Rate Premia: Some Tests From the GNMA Market," presented at a joint session of the Annual Meetings of the American Economics and Finance Associations, Denver, Colorado, September 1980.

as twice the six month coupon rate, and coupons are paid every six months (a bond with a stated 12 percent annual coupon rate actually pays a 6 percent coupon every six months). Annual mortgage coupon rates (MCoup) are stated as 12 times the one month coupon rate, and payments are made monthly (a mortgage with a stated 12 percent annual coupon rate actually pays 1 percent per month). Moreover, a servicing fee (SER) of between 3/8ths and 1/2 of a percent (at an annual rate) of the outstanding mortgage principal is typically charged for collection, but no fee is charged for clipping the bond coupon.

A second difference between coupon rates and expost yields on par value securities held to maturity is that the former are based on promised payments and the later on those realized. For our current purpose, we assume that lenders know in advance that they will lose through default an annual yield equivalent of d_m basis points on mortgages and d_b basis points on bonds. The net yield on a mortgage, on an annualized basis and after adjusting for monthly coupon payments and default losses, is defined as:

$$m = [1+ (MCoup-d_m-SER)/12]^{12}-1.$$

The net yield on a bond, again on an annualized basis and after adjusting for semi-annual coupon payments and expected default losses, is defined as:

$$b = [1+ (BCoup-d_b)/2]^{2}-1$$

In the certainty model described above, these net yields are comparable as long as the bond maturity is chosen in the above described manner. Thus, a firm should invest in bonds if and only if $b \geq m$.

B. Underwriting Advantages

Origination costs are generally paid by the issuers and thus are not of concern to the investor. Bond issuers pay investment bankers directly to underwrite new issues, and mortgage originators can be viewed as charging borrowers an up front fee in a similar manner. However if savings and loans have a cost advantage in underwriting (originating and servicing) mortgage loans or corporate bonds, then this might affect their profits and investment strategy.

Mortgage originating requires fairly close contact with buyers and sellers in local markets as well as with a variety of other service providers. Thus local "production" offices must be established to take applications, conduct property appraisals and surveys, verify income, review title searches of local records and close loans. Mortgage servicing may also require local market proximity, especially in the event of default and foreclosure.

Depository institutions have likely enjoyed a comparative cost advantage in the production of mortgage loans, especially in less densely populated areas. This is because deposit intermediation requires a similar network of local offices. Limits on deposit rates stimulated further branching into smaller sub-markets. The marginal fixed cost of producing mortgages in existing branch offices thus amounts to little more than the salary of a loan officer and cost of an additional desk. Depository institutions have thus been able to operate mortgage production offices in narrow markets where it may not be feasible for a mortgage banker to do so.

It is difficult to quantify the magnitude of this cost advantage in the past and speculative to do so for the future. Improvements in communication and transportation systems reduce the cost advantages of physical proximity. For example. the technology currently exists for computerized land recordation systems with long distance telephone access. Similarly, most income verification data are computerized. Property appraisals and surveys must be done locally, but these services are typically provided by independent firms and the information is easily communicated over long distances. Even applications may be taken through the mails, albeit with some delay. Moreover, the gradual phaseout of deposit rate ceilings required by the Depository Institutions Act of 1980 may result in fewer branches. In summary, what cost advantages savings and loans currently enjoy will likely erode gradually over time but not be eliminated completely. Because similar cost advantages probably exist for mortgage servicing in that the collection and compilation of monthly payments closely resembles the deposit-taking function, savings and loans would also appear to have a comparative advantage in servicing mortgages.6/ This analysis suggests that at least some savings and loans can compete successfully with mortgage bankers in the origination of mortgages for other investors.

Savings and loans have a special advantage in originations for their own investment: they avoid the costs of putting the loan in the portfolio

---

6/ Moreover, in the event of default, foreclosure requires on-site representatives and knowledge of local real-estate markets and state and local law regarding the foreclosure process.

of a permanent lender. These costs include commitment fees or dealer fees of one sort or another and the additional expense of conveying information to the lender regarding the probability of loss or "quality of the underwriting" (the investor may require an independent appraisal or guarantee, e.g., FHA, PMI, FHMA or FHLMC "approved underwriter"). This special advantage will have one of two possible direct effects. The first is that savings and loans pass these savings on to homebuyers. The second is that they earn additional profits from mortgage originations for their own portfolios, profits that will affect the bond/mortgage investment decision. We have no direct evidence on which of these is more likely. Intuition suggests that mutually-chartered institutions are more likely to do the former (especially for depositors) and stock-chartered institutions the latter. If p is the additional annualized profit on a dollar of funds invested in mortgages, then the investment decision becomes: buy bonds if and only if $b \geq m+p$.

Next consider the economic potential for savings and loans to originate corporate securities. The underwriting of corporate debt requires a substantially different set of skills and services than that described above. Evaluation of the borrower's credit-worthiness requires information and sophisticated expertise in analyzing corporate balance sheets and profit and loss statements, industry trends, etc. Because corporate debt issues are much larger than mortgage debt issues, there are economies of scale to this information and expertise. Savings and loan institutions are at a competitive disadvantage to large investment

bankers in the underwriting of large corporate issues by major firms and would not underwrite such loans for their own portfolio. The underwriting of small corporate loans (commercial and industrial loans) resembles mortgage underwriting more closely than the underwriting of large corporate issues. Thus savings and loans likely would have similar production functions to those of commercial banks for commercial -- particularly real estate related -- loans and would have obvious advantages over investment bankers. However, legal restrictions preclude savings and loans from originating such loans.

C. Tax Preferences of Savings and Loans

The tax-preference currently granted savings and loans (SLAs) is their ability to compute loan loss reserves that far exceed a reasonable provision for normal losses. In effect, SLAs have been allowed to transfer large portions of their before-tax income to reserves, thereby avoiding taxation on this income. Prior to 1963, the effective tax rate on aggregate SLA income never exceeded 2 percent; SLAs were, in effect, allowed to transfer virtually all income to reserves. In the 1962 Revenue Act, Congress limited the transfer to reserves, with some exceptions, to 60 percent of taxable income. The Tax Reform Act of 1969 lowered this percentage in steps over time, still with some exceptions, so that in 1979 the percentage is only 40.7/

7/ The 1969 legislation also introduced a minimum tax of 15 percent to be applied to SLA tax preferences, the most important of which is the difference between their bad debt deduction and that allowed under the experience method, less $10,000 and the regular tax paid. (The minimum tax has been modified in recent legislation.) In the Financial Institutions Acts of 1973 and 1975, the Treasury proposed substitution of a 3 1/2 percent mortgage interest tax credit for the extraordinary provisions for loan losses.

The usual approach to the determination of optimal portfolio behavior is maximization of the net worth of the firm. In general, this is equivalent to maximizing the discounted present value of expected net after-tax profits (where the appropriate rate of discount is the after-tax real rate). To simplify matters, the following two assumptions are added. First, future interest rates are known with certainty and equal current rates. Second, there are no transactions costs to buying or selling securities. Under these assumptions, maximizing net worth is equivalent to maximizing current after-tax profits.

Here we consider the simple case where total financial assets at the beginning of the year (A) are exogenous, and there are only two possible assets in the portfolio, mortgages (M) and bonds (B). The firm is assumed to carry over these stocks of mortgages M_{-1} and bonds B_{-1} with average net yields of $\bar{m}$ and $\bar{b}$, respectively. The problem then reduces to the allocation of new funds made available at the beginning of the year between bonds and mortgages so as to maximize current profits. The cost of all funds is, for simplicity, c, which includes the cost of collecting and servicing them. The before-tax profit of a firm is

$$\pi^b = \pi^b_e + [\delta(m+p)+(1-\delta)b-c]F \qquad (1)$$

and

$$\pi^b_e = (\bar{m}-c)M_{-1} + (\bar{b}-c)B_{-1} + X$$

where

π_e^b represents predetermined profits,

X is non-investment earnings less costs not otherwise specified,

F is the amount of "new funds" made available at the beginning of the period. [$F = \Delta L + R$, where ΔL is the (exogenous) net increase in liabilities and R is the repayment from amortization and prepayments.]

δ is the proportion of new funds invested in mortgages, and

p is the profit from the mortgage underwriting of loans held.

The SLA is assumed to pay the normal tax rate, τ, subject to an extraordinary provision for loan loss reserves. This provision is calculated in the following manner. If the SLA holds 82 percent or more of its assets in mortgages (the dominant "qualified" asset), then it pays taxes on $1-\bar{s}$ of its "taxable" income (by statute, $\bar{s}$ is currently 0.4); if the SLA holds less than 60 percent of its assets in mortgages, then it pays taxes on all of its income; for each percentage point below 82, but above 60, the firm holds in mortgages, the fraction of income that is not taxed is reduced by three-quarters of a percentage point .8/ In effect, the SLA is allowed to avoid paying tax on a fraction (s) of its normally taxable income. That is,

$$\pi^a = [1 - \tau(1-s)]\pi^b, \qquad (2)$$

8/ These are the current regulations for SLAs. MSBs pay taxes on $1-\bar{s}$ of their taxable income if they hold more than 72 percent of their assets in the favored investment, and for each percentage point below 72, but above 60, the fraction of income taxed declines by 1.5 percentage points.

where

$$s = \bar{s} - 0.75(0.82-\bar{\delta})Z,$$

$$\bar{\delta} = (M_{-1}+\delta F)/A = M/A, \text{ and}$$

$$Z = \begin{cases} \bar{s}/0.75(0.82-\bar{\delta}) & \bar{\delta}<0.6 \\ 1 & 0.6\leq\bar{\delta}\leq 0.82 \\ 0 & \bar{\delta}>0.82. \end{cases}$$

As long as $\bar{\delta}>0.82$ or $\bar{\delta}<0.6$, there is no tax advantage to incremental investment in mortgages and the investment rule derived in the previous section holds, namely purchase bonds if $b\geq m+p$. The more interesting case arises when $0.6\leq\bar{\delta}<0.82$. To determine the allocation of new funds to mortgages that maximizes after-tax profit in this case, we take the partial derivative of (2) with respect to δ, after substituting from (1) and allowing for the dependency of s on δ, set the result equal to zero and solve for the optimal δ, denoted by δ^*:

$$\delta^* = \frac{\pi_e^b + (b-c)F}{2[b-(m+p)]F} - \frac{(1-\hat{\gamma})A}{1.5\gamma F},$$

where $\hat{\gamma} = \gamma[(1-\bar{s}-0.75(0.82-M_{-1}/A)]$ is the effective tax rate when no mortgages are purchased.

An explicit expression for current purchases of bonds, B^p, can be obtained by substituting the definitions $\delta^* = M^p/F$, where M^p is current mortgage purchases, and $M^p+B^p = F$ into (3) and solving

$$B^p = \left(1 - \frac{b-c}{2[b-(m+p)]}\right)F + \frac{(1-\hat{\tau})A}{1.5\tau} . \qquad (4)$$

Bond purchases will be greater,

(i) the greater is the net premium earned on bonds $[b-(m+p)]$,

(ii) the greater are net funds (F),

(iii) the lower is the premium earned on bonds over the cost of funds (the greater is this premium, the more valuable are mortgages as a device to lower taxes)

(iv) the lower is the effective tax rate in the absence of mortgage purchases ($\hat{\tau}$).

D. Transactions Costs and Other Factors

Technically, the only relevant range for solutions in the model are for δ^* between zero and one. In this range, the maximization implies that the after-tax yield on the marginal dollar invested in mortgages equals the after-tax yield of the marginal dollar invested in bonds. Beyond this range other factors not incorporated in the model, such as transactions costs and capital gains taxes, come into play.

When $\delta^*>1$, current after-tax profit may (or may not) be increased by selling existing bonds in the portfolio and buying new mortgages with

the proceeds. The result depends on the treatment of realized capital losses (or gains) and sales transactions costs involved. Because SLAs currently do not hold bonds to sell, this case may not appear relevant. However, we note that the issue of mortgage-backed bonds is analogous to the liquidation of bonds from the asset portfolio. Finally, when $\delta^*<0$, possibly the firm should sell mortgages out of its existing portfolio and buy bonds. Again, the ability to sell existing mortgages, the existence of sales costs, and the tax treatment of capital gains or losses are relevant. It may be optimal to buy only bonds for several years, rather than to sell existing mortgages, in order to avoid transactions costs.

Consider the implications of the additional transactions costs involved in selling existing mortgages. Suppose that $\delta^*<0$. We can calculate the mortgage yield such that the SLA firm is holding the desired stock of mortgages by setting $\delta^*= 0$ and solving equation (3) for m^0. The result is

$$m^0 = b - \frac{0.75\tau\pi^b}{(1-\tau)A} - p, \qquad (5)$$

where the three terms denote the yield earned on bonds, the tax advantage foregone by investing in bonds, and the origination profits lost by investing in bonds. Let t denote the annualized yield equivalent sales cost of selling a dollar of mortgages. The firm should sell mortgages and buy bonds if the yield it gives up (m+t) is less than m^0, the yield at which it is willing to hold mortgages. If $m+t>m^0$, then the sales costs are greater than the potential yield advantage to the sale and the firm is better off not selling old mortgages to buy new ones.

E. Determination of Market Yields

As discussed above, savings and loan assocations receive a tax preference that allows them to invest profitably in mortgages at a lower yield than other investors. Here we consider how this preference may affect the determination of market yields, assuming that markets equilibrate after-tax net yields.

A supply curve for mortgage credit at savings and loans may be derived directly from equation (3) by multiplying through by new funds (F) and summing across all n institutions. The total (implicitly annual) flow supply of mortgage credit at savings and loans is:

$$\sum_{i-1}^{n} M_i^p = \sum_{i=1}^{n} \delta_i^* F_i, \qquad (6)$$

where the i subcript refers to the ith individual SLA. The δ_i^* may vary widely across associations owing to differences in yields on existing bonds and mortgages ($\bar{b}$ and $\bar{m}$), in other income and expenses (X), and in effective tax rates (M_{-1}/A). Equation (5) indicated the relationship between mortgage and bond rates that is consistent with zero desired mortgage purchases ($\delta^* = 0$). By setting $\delta^* = 1$ and solving for m^1, we can obtain the relationship that is consistent with zero desired bond purchases:

$$m^1 = b - \frac{0.75\tau\pi^b}{(1-\tau)A+0.75\tau F} - p. \qquad (7)$$

This differs from (5) only in the appearance of $0.75\tau F$ in the denominator. Table 1 illustrates the sensitivity of SLA flow mortgage supply to a key

Table 1: The Spread (in Basis Points) Between the Net Bond and Mortgage Rates That Would Result in the Purchase of Only Bonds or Mortgages*

Assumed Profit Rate (π^b/A)	Mortgage Purchases Only	Bond Purchases Only
0.001	b-m< 4	b-m> 5
0.005	b-m<23	b-m> 25
0.01	b-m<45	b-m> 50
0.015	b-m<68	b-m> 75
0.02	b-m<91	b-m>100

* Assumed values of other variables: $p = 0.0$, $\tau = 0.5$, $\hat{\tau} = 0.25$, $F = 0.2A$.

variable, the before-tax return on assets.[9/] When the spread between the net bond and mortgage rates is large, say 100 basis points, only associations with very high profit rates, $\pi^b/A \geq 0.02$, will purchase mortgages. As the mortgage rate rises relative to the bond rate, SLAs with lower and lower profits will find it advantageous to purchase mortgages. As the profit rate approaches zero, associations will purchase mortgages only if the mortgage rate (plus p) approaches the bond rate.

We may infer the following regarding the properties of this supply function. First, there is a net mortgage rate sufficiently below the net bond rate such that no SLAs will invest in new mortgages. This rate is denoted in Chart I by m' and depends on:(1) the increase in the portion of income upon which savings and loans pay taxes when they shift from

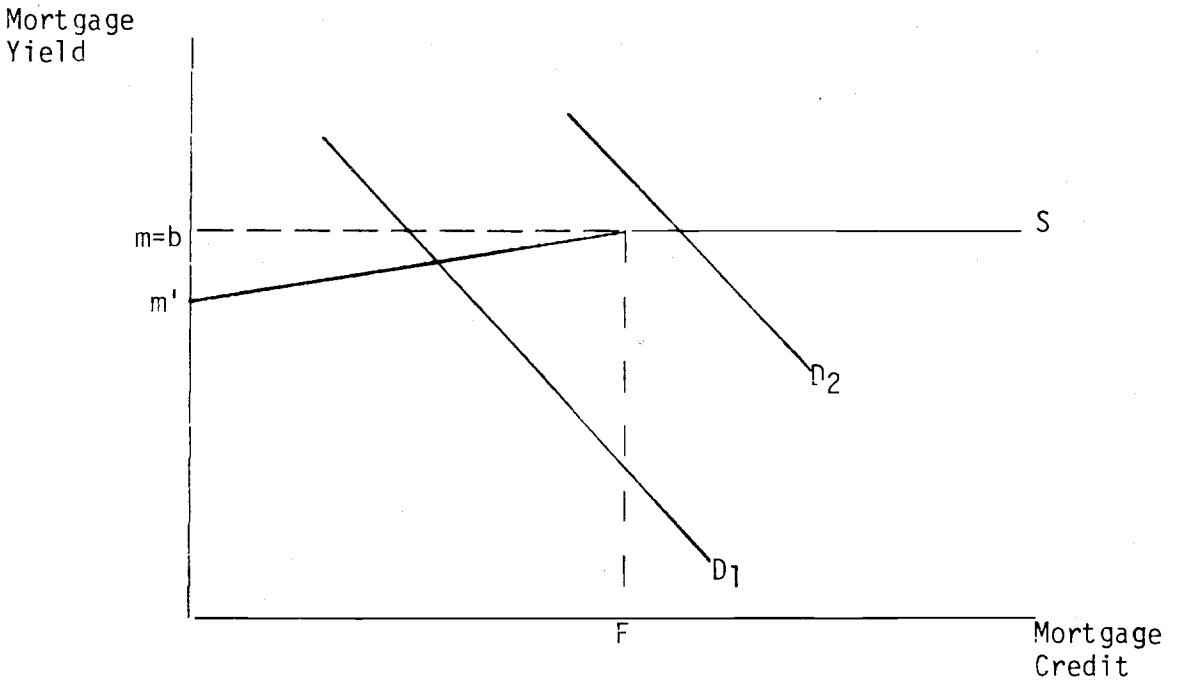
---

9/ For the savings and loan industry as a whole, π^b/A rose from 0.0081 in the first half of 1976 to 0.0121 in the second half of 1978 and fell back to 0.0009 in the first half of 1980.

qualified to other assets -- the current three-quarters of a percentage point and (2) the profit rate of the most profitable institution. Second, as the net mortgage rate increases, progressively more thrifts will find it profitable to invest in mortgages and the share of deposits allocated to mortgages by individual SLA firms will rise. At the extreme, all new funds of all SLAs -- even those with no profits -- will be invested in mortgages when the net mortgage rate approaches the net bond rate. These properties allow us to specify a continuous (and, for simplicity, linear), rising aggregate mortgage credit supply function for SLAs as depicted in Chart I. In this model the supply of mortgage credit at SLAs is truncated at F -- total new funds available for new investment --

Chart I

Tax Preferences, the Demand for Mortgage Credit and Determination of the Mortgage Rate



because this supply was taken as exogenous. However, at the point where m=b, "bond" investors switch to mortgages either directly or via the purchase of GNMAs, FHLMC participation certificates or FNMA debt.10/ Thus the aggregate flow supply of mortgage credit, S, becomes horizontal at b.

When the flow demand for mortgage credit by households, D_1, falls short of the potential supply at SLAs, the equilibrium before-tax net mortgage yield is below the before-tax net bond yield, only investors with tax preferences invest in mortgages, and some tax preference investors (e.g., those with low profits or little marginal tax preference) invest in bonds. When the household demand for mortgage credit, D_2, exceeds the potential supply by tax-preference investors, the equilibrium before-tax net mortgage yield equals the before-tax net bond yield, and some SLAs may be indifferent to bonds if there is no tax consequence.

Before concluding this section, it is probably useful to consider the implications of a reduction in, or outright removal of, the savings and loan tax preference. In 1978, the Treasury proposed a gradual reduction in the percentage of taxable income that can be transferred to loan loss reserves from 40 to 30, and preliminary discussions were based on a reduction to 20. More recently, the Interagency Task Force on Thrift

---

10/ For a discussion of this behavior, see Hendershott and Villani, "Secondary Mortgage Markets and the Cost of Mortgage Funds," AREUEA Journal, vol. 8, Spring 1980.

Institutions implicitly recommended removal of the tax preference.[11] Removal would make the entire supply schedule in Chart I horizontal; savings and loans would be indifferent between bonds and mortgages unless there were profits from originating mortgages for their own investment. More importantly, removal might cause savings and loans to invest as much as 10 percent of their assets in tax-exempt securities.[12]

II. Bond and Mortgage Investment with Uncertainty

In the simple model employed above, portfolio decisions were assumed to be motivated by net (of taxes, transactions costs and default losses) yields, where the relevant variables in the yield equations were assumed to be known with certainty. Here we allow for uncertain future interest rates and describe the relationship between mortgage and deposit life and actual future interest rates. Part A of this section describes the various "options" that characterize the SLA portfolio. Part B discusses how efficient financial markets would price these options, how these prices should affect market-determined mortgage and bond coupon rates, and how

---

11/ The Report of the Interagency Task Force on Thrift Institutions, Department of the Treasury, June 30, 1980, pp. 107-113. The Task Force was established, at least in part, to study the problems that SLAs might have during the transition to competitive markets. The Task Force then implicitly proposed a tax increase (removal of the tax preference) as a cure for the problem of severely depressed SLA earnings.

12/ Patric H. Hendershott and Timothy W. Koch, "The Demand for Tax-Exempts by Financial Institutions," Journal of Finance, June 1980.

heterogeneous interest-rate expectations will lead some associations to invest in bonds. The portfolio risk of SLAs and the investment strategy of risk-averse associations is the subject of Part C.

A. Portfolio Options[13/]

In our earlier analysis we compared net yields on a mortgage and a bond, assuming that they had identical, certain repayment cash flows and that future interest rates were known with certainty. If we were to drop only the interest rate assumption, then interest rate outcomes other than those expected would affect the values of these investments identically. Unexpectedly low interest rates raise the market values of both by equal amounts and unexpectedly high interest rates do the opposite. However, mortgage cash flows are not certain, and are in fact correlated with interest rates. The stochastic mortgage cash flow is related to the "put and call options" imbedded in mortgage contracts. In addition, depositors may prematurely cash existing certificates if interest rates rise sufficiently. As it turns out, this is a "put option" which has the same properties as mortgage put options.

The typical manner in which SLAs originate mortgages is to give (for an "origination fee") a commitment to a homebuyer that the lender is willing to make a loan at a predetermined rate of interest and, implicitly, price (loan principal less points). The homebuyer has bought a put-option

---

13/ For a fuller discussion of these options, see Kenneth J. Thygerson, "Futures, Options, and the Savings and Loan Business," in this volume.

from the lender; i.e., he has the right to "put" the loan in the lenders' portfolio during the life of the commitment which may vary from a month to over a year. The value of the put option to the homebuyer at the time of loan closing is positively related to the spread between the commitment rate and the new issue spot rate.

A second form of put options SLAs often implicitly sell is also contained in the mortgage contract. Borrowers can terminate fewer (or more) than the normal volume of mortgages. When interest rates rise, more mortgages will be assumed by buyers than is normally the case, and some homeowners will forego moving so as to avoid giving up their now below-market fixed-rate mortgage. In effect, borrowers have "put" a greater than anticipated volume of "old" mortgages in the lenders' portfolio. Conversely, when interest rates fall, borrowers will "call" mortgages and refinance them at lower rates.

A third form of put options SLAs implicitly sell relates to their deposits. Consider the simple case of a fixed-rate, two-year certificate with no penalties for early withdrawal. If interest rates rise after one year, then the certificate-holder will "put" the certificate back in the lenders' portfolio. That is, the holder has the right to cash the certificate in at par value when the market value is below par. In reality, penalties limit this potential, but the "put options" aspect of SLA certificates nevertheless remains.

The portfolio of savings and loans is thus exposed to incredible options risks. SLAs sell put options for new mortgage loans (commitments),

old mortgage loans (assumptions) and deposits (early withdrawal). Moreover, they sell call options on mortgage loans (refinancings). Most important, the effect of the put options is cummulative; i.e., there is a strong likelihood that they will all be exercised if interest rates rise sharply.

B. Options Pricing, Market Yields and Portfolio Choice

Conceptually, we may separate mortgage yields into two component parts. The first reflects the cost of financing when the terms of the contract -- the timing and magnitude of all interest and principal payments -- are known with certainty. The second reflects the price of the "option" that the timing and/or magnitude may differ from that contracted for. In Section I we described the determination of market yields when the terms were known with certainty. Here we provide an intuitive description of how competitive, risk-neutral markets would price the "options" in mortgage and savings certificate contracts and point out the implications for mortgage and bond yield comparisons and portfolio choice.

When a borrower exercises his "option" to default on a mortgage loan, the investor loses interest (during the period in which the loan is in default) and perhaps principal (depending on the proceeds from sale upon foreclosure). Similarly, when interest rates fall and a mortgage is refinanced, the investor loses the difference in interest payments over the life of the loan. The loss from an assumption or delivery of a mortgage against a below-market rate commitment, or the loss from the cashing in of a certificate of deposit at an old rate and the reissue at

a higher rate may be calculated in a similar manner. In other words, we may calculate the actual loss when the option is exercised.

We do not know a'priori when, or if, the option will be exercised. But we may know what the determinants of the exercise of the option are, and we can assign a'priori probabilities to the likelihood that these determinants will take on the value such that the option will be exercised. The appropriately discounted present value of the product of these probabilities and the losses upon exercise of the option is:

$$O_m = \sum_{j=1}^{n} \frac{l_j L_j}{(1+i)^j},$$

where

l_j is the contingent probability distribution based on current expectations that the option will be exercised in period j,

L_j is the loss in period j if the option is exercised,

i is the nominal risk-free discount rate, and

$$l_j L_j = \sum_{h=1}^{n} l_j^h L_j^h .$$

The superscripts denote the likelihood of a particular outcome (h) resulting in the exercise of the option and the loss associated with that outcome.

In the case of commitments, refinancings and assumptions, the contingent probabilities and the loss if the option is exercised depend on the difference between current and expected future mortgage rates. Similarly, the contingent probabilities and the loss from early withdrawal

depend on the difference between current and expected future deposit rates. In both cases, the loss associated with every potential interest-rate outcome is weighted by the anticipated likelihood with which it will occur. For example, l_2^h could be the likelihood, given current expectations, that the mortgage rate will be 200 basis points (h = 200) less in two years than it is now. L_2^h is the loss resulting from refinancings in this event.

For a mortgage commitment, lenders typically charge a front end price proportional to the principal. This is a single-premium fee (commitment fee) which in competitive, risk-neutral markets will equal the "actuarial" present value of the loss. The price of the refinancing and assumability options are typically paid in the form of a higher mortgage coupon rate, where the premia built into the rate, O_m, is determined actuarially such that the discounted present value of the monthly premia and the probability-weighted losses are equal.

The actuarial monthly premia for mortgage default risk and semi-annual mortgage premia for bond default risk are calculated in a similar manner and were defined above as d_m and d_b, respectively. The net-yield on a par-value mortgage, adjusted for the "actuarially" determined monthly options and default premia in mortgage rates, is:

$$m^o = [1+(MCoup-O_m-d_m-SER)/12]^{12}-1.$$

The net yield on a par-value bond, adjusted for the actuarially determined semi-annual options (O_b) and default premia in bond rates is:

$$b^o = [1+(BCoup-O_b-d_b)/2]^2-1.$$

In the absence of tax preferences, the bond purchase decision is again buy bonds if and only if $b^o \geq m^o+p$, where the yields are defined above and p equals any excess returns to mortgages placed in the firms' own portfolio.

If potential investors have homogeneous or uniform interest-rate expectations and thus identical valuations of O_m(and of O_b), then competitive, risk-neutral capital markets will -- in the absence of tax preferences or relative underwriting advantages to the marginal investor -- equate b^o and m^o. However, if expectations and thus valuations are heterogeneous, then those with valuations of options risk that are greater than the "market's" will tend to purchase bonds and others will favor mortgages. Thus bonds provide a useful alternative to associations who believe that the options premium incorporated in the mortgage coupon rate is insufficient.

We may calculate, in a similar manner, the cost to the firm of the borrowers' ability to cash in existing certificates if the advantages of doing so outweigh the penalities. Competitive, risk-neutral deposit markets will equate this cost, c^o, to the yield on otherwise comparable securities without the early withdrawal feature.

C. Risk Aversion and Portfolio Choice

The above discussion suggested that SLAs are subject to substantial upside interest-rate risk. This is no surprise to students of the savings and loan industry. Even if the options premia built into mortgage coupon rates and the inflation premium built into interest rates generally had accurately reflected expectations at the time loans were made, substantial

SLA losses would have resulted from actual inflation rates and interest rates being much higher than generally expected during the past 15 years. Moreover, recent volatility in interest rates and the uncertainty regarding the future has dramatically increased the actuarially-determined price of options in the SLA portfolio. This results because -- based on a'priori expectations -- the probability that a given option will be exercised is increased by interest-rate uncertainty. In the remainder of this section, we modify our earlier model to allow for this risk and ask how aversion to this risk might affect the bond/mortgage investment decision of savings and loans.

The analysis of Section I is altered in that profit is now a random variable because a number of its determinants are stochastically determined. In addition, for our current purpose we extend the model to include liabilities with a maturity greater than one period, although all liabilities issued at the same point in time are at the same rate. The proportion of liabilities issued with greater than one-period maturity, which pay $\bar{c}$, is denoted by γ. The expression for after-tax profit is then

$$\pi^2 = [1-\tau(1-s)]\{\bar{m}\, M_{-1}+\bar{b}\, B_{-1}-[\gamma\bar{c}+(1-\gamma)c]L_{-1}+[\delta m+(1-\delta)b]F-c\Delta L\}.$$

M_{-1}, γ, m, b and c are all stochastic random variables, $F = \Delta L+R$, and $L_{-1} = B_{-1}+M_{-1}+R$, where R equals repayments (made at the beginning of the period). The stochastic behavior of M_{-1} results from the mortgage commitment and assumability put options and the refinancing and the call

option. The stochastic behavior of γ results from the early withdrawal feature of certificates.

To determine the implications of a change in interest rates for the profitability of an existing portfolio, we calculate the differential of the above expression (holding δ constant) and divide through by dc.[14] By definition, $\partial R/\partial m = -\partial M_{-1}/\partial m$. By assumption, interest rates on old and new securities are initially equal and all interest rates on new securities change by the same amount (dc = dm = db). The resulting expression is

$$d\pi^a/dc = [1-\tau(1-s)]d\pi^b/dc, \text{ where}$$

$$d\pi^b/dc = -(1-\gamma)L_{-1} + \gamma R - [\delta m+(1-\delta)b-\bar{m}](\partial M_{-1}/\partial m) - (\bar{c}-c)L_{-1}(\partial\gamma/\partial c).$$

Maturity Imbalance | Mortgage Options | Early Withdrawal

The first two terms on the right-hand side of the above expression reflect the maturity imbalance loss or gain.[15] This is the change in profit on the existing stock of assets financed at the new liability rate and on that part of the reinvestment of repayments that is financed by old

---

14/ Technically the expression is not differentiable because the options risk of rising interest rates is not symmetric with the options risk of falling interest rates. Here we describe the implications of a rise or fall separately.

15/ For a useful discussion of the maturity inbalance problem, see Dwight M. Jaffee, "The Asset/Liability Maturity Mix of S&Ls: Problems and Solutions," Change in the Savings and Loan Industry, Proceedings of the Second Annual Conference, FHLB of San Francisco, 1976.

deposits. The change in profit is symmetric with respect to rising or falling interest rates. That is, the loss from a rise in rates [assuming that $\alpha R<(1-\alpha)L_{-1}$] equals the gain from a fall in rates of equal magnitude.

Regarding the third term on the right-hand side, when $dm>0$, $(\partial M_{-1}/\partial m)$ is the increase in the existing mortgage stock from commitments and assumptions; when $dm<0$, $(\partial M_{-1}/\partial m)$ is the decrease in the existing mortgage stock from refinancing. The loss to profits in either event is simply the product of the change in mortgage and bond revenue per dollar change in the existing mortgage stock times the change in the stock. There is no a'prior reason to believe that these two effects are of the same magnitude for positive and negative rate changes. But it is the case that after-tax profit will unambiguously decline as a result of the stochastic behavior of M_{-1} in response to increases or decreases in interest rates.

The fourth term reflects the increased cost of refinancing old deposit certificates at the new deposit rate. The greater the rise in rate and the response of depositors to this rate, the greater the loss. This term is only defined for $dc>0$ because there is no gain from falling interest rates.

When interest rates rise unexpectedly, SLAs lose on four counts: the rise in the cost of new liabilities not offset by a rise in earnings on existing asset holdings, the refinancing of old liabilities at higher rates, the exercise of outstanding mortgage commitments, and the increase in assumptions. Thus SLA firms are exposed to substantial risk from

unexpectedly rising interest rates. There are immediate remedies to these sources of potential loss: shorter effective term mortgages (VRMs and RRMs) and longer term deposits, stiffer penalities for early withdrawal, and enforcement of due on sale clauses to reduce assumptions. SLAs have recently taken actions in all of these areas. In addition to these direct mechanisms, SLAs may purchase put options -- secondary market commitments -- to offset partially the put options they sell. But there are limits as to how much maturity imbalance and options risk can be reduced by making changes in mortgage and savings certificate contracts, and the purchase of commitments is relatively expensive. Another way to reduce the risk to the total portfolio of rising interest rates is to purchase relatively shorter-term and/or noncallable corporate securities. That is, risk-averse SLAs may buy noncallable bonds when b^o is slightly less than m^o+p, even after allowance for the tax advantage.16/ They may be willing to accept lower expected profit for improved stability and less risk of loss from an unexpected secular increase in interest rates.

III. Summary

The extent to which any investor would purchase corporate debt securities, as opposed to mortgages, obviously depends on a comparison

---

16/ Another possible reason for investment in bonds is diversification against the risk of default. Mortgage default depends on the real value of homeowner equity which in turn is related to the rate of inflation in house prices. Corporate default depends on earnings which in turn depend on the general state of the economy. A mixed portfolio of mortgages and bonds is thus somewhat diversified against the risks of falling house prices and declining economic activity.

of yields on bonds and mortgages. The comparison is manageable in a world where future interest rates, termination or repayment rates, and default rates are known with certainty. Coupon rates on equal effective-maturity par-value bonds and mortgages can be adjusted for known default losses and for differences in servicing costs and in payment periods. We denote these adjusted rates by b and m. The appropriate investment strategy is simply to choose the asset with the greater adjusted coupon rate.

Of course, there is substantial interest-rate uncertainty, and, as a result, cash flow uncertainty. Unexpected cash flow outcomes tend to affect the returns on mortgages adversely relative to those of bond portfolios. Lower than expected interest rates increase refinancings and reduce assumptions, thereby producing greater than expected cash flows to be invested at the unexpectedly low yield. Higher than expected interest rates increase assumptions and decrease the willingness of households to move, producing lower than expected cash flows to be reinvested at unexpectedly high yields. Thus, no matter how interest rates evolve, the expost difference in holding period returns on mortgages and bonds will fall short of the difference in adjusted coupon rates. To compensate for the likelihood of these adverse changes in mortgage termination rates and the resultant shortfall in relative expost return, an options premium must be built into mortgage coupon rates. We denote the difference between the individual association's valuation of the annualized premium

necessary to make them indifferent between bonds and mortgages that are otherwise equivalent investments and the market's valuation by ϕ(opt). With uncertainty, the investment rule is buy bonds if $b^o > m^o - \phi$(opt).

While this rule might be appropriate for life insurance companies and pension funds, it is not correct for savings and loan associations because they have two special incentives to invest in mortgages. First, if mortgage bankers can originate and place mortgages in the portfolios of ultimate investors without losing money, then savings and loans can surely originate for their own portfolios at a profit. The annualized yield equivalent of this extra profit is represented by θ(orig). Second, there are, or can be, tax preferences for marginal investments of savings and loans in mortgages. The value of these, which depends on the association's before-tax profits per dollar of assets and percentage of assets already in mortgages, is represented by Ψ(tax). With these adjustments, the investment strategy for a risk-neutral savings and loan now becomes: buy bonds if

$$b \geq m - \phi(\text{opt}) + \theta(\text{orig}) + \Psi(\text{tax}).$$

This rule only holds for the investment of "new" funds, i.e., increases in liabilities plus repayments of assets; if the association is contemplating the sale of existing mortgages to purchase bonds, then the probably prohibitive sales costs must be taken into account.

One further point regarding the bond-mortgage investment choice. In the 1970s savings and loan associations were subject to enormous upside interest-rate risk. Unexpected increases in rates raised interest expense

faster then interest income because the average maturity of liabilities was shorter than that of assets. Moreover, the effective maturity of liabilities would shorten (early withdrawals would occur) and that of mortgages would lengthen (more mortgages would be assumed and households would become less mobile). This risk could have been tempered by investment in noncallable, shorter term corporate debt. The recent increase in penalties for early withdrawal of deposits and the shift to variable rate, rollover and equity participation mortgages has reduced this risk, although the increased volatility of interest rates has mitigated the reduction. In any event, the above investment rule should be tilted slightly toward bonds for associations that are averse to this risk.

The final question is: if savings and loans follow the appropriate bond investment rule, will they actually purchase bonds? The answer, of course, depends upon what mortgage and bond coupon rates are, in fact, determined in the marketplace. Under present tax law and assuming homogeneous interest-rate expectations, it appears that relatively profitable risk-neutral assocations would never wish to purchase bonds and that less profitable associations would do so only when the demand for mortgage funds is weak. That is, probably no risk-neutral associations would have invested in corporate debt in the 1976-79 period had the option been available. If the demand for mortgage funds is weak, then more profitable savings and loans will compete away some of the value of the tax preference by bidding down mortgage rates, and less profitable associations will find corporate debt to be an attractive alternative. Moreover, noncallable, shorter term corporate debt would be more attractive to risk-averse

associations. If the tax preferences of savings and loans were removed, then risk-averse associations would likely make significant use of their authority and all associations would probably allocate significant funds to tax-exempt securities. Lastly, if interest rate expectations are heterogeneous, some associations will believe that the options premium built into the mortgage coupon rate is insufficient to compensate for mortgage cash flow uncertainty. These associations will tend to find bonds to be an attractive alternative to mortgages.