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An Analysis of Countercyclical Policies of The FHLBB

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ABSTRACT

Three policies of the Federal Home Loan Bank Board, the Specially Priced Advances Program in 1970–1, a program of advances at a reduced interest rate in 1974, and changes in the minimum liquidity ratio, are analyzed. A model of portfolio allocation is developed and estimated for savings and loan associations. Most of the net increase in advances borrowed under the first two programs have not been lent in the mortgage market. Reductions in the minimum liquidity requirement have resulted in an increase in mortgage lending, but substantial effects are not felt until a year after the liquidity requirement is reduced.

SINCE 1968 THE FEDERAL Home Loan Bank Board has used several policies in an attempt to reduce fluctuations in the mortgage market, and therefore also in the housing market. In 1970 and 1974 the Federal Home Loan Bank Board (FHLBB) offered special programs of advances at a reduced interest rate in order to increase the supply of mortgage funds by savings and loan associations (SLAs).[1]

During the tight money period in 1966 advances borrowed by SLAs peaked at almost $7.2 billion in 1966.3. As savings shares deposited at SLAs increased after the disintermediation in 1966 SLAs used a substantial proportion of the new deposits to reduce outstanding advances. From the third quarter of 1966 to the third quarter of 1967 the level of advances decreased by over three billion dollars.

In order to have SLAs use the increase in deposits immediately after the tight money period in 1969–70 to lend in the mortgage market rather than to repay advances, and thus support housing construction, the FHLBB established the Specially Priced Advances Program in April 1970. "Most members were offered a reduced advance rate provided they converted their outstanding borrowings into advances repayable before the end of one year, only upon payment of a penalty." [4, 1970, p. 40] At the end of 1970 advances under the program totaled $8.7 billion.[2]

In May 1974 the FHLBB established a program of advances at a reduced rate in order to increase the supply of mortgage funds during a period of disintermediation. Special 5-year advances, at an interest rate below the current market rate for 5-year obligations, were available at a rate of approximately $500 million

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[1] A fundamental purpose of the Federal Home Loan Bank System (FHLBS) is to supplement the resources of savings and loan associations. Advances are loans from the Federal Home Loan Bank System to member institutions.

[2] See [4, 1970, chap. 4] for details on the Specially Priced Advances Program.

a month during the last eight months of 1974 [1]. By the end of 1974, $3.55 billion had been advanced or committed under this program [4, 1974, p. 23].

Since 1950 SLAs that are members of the FHLBS have been subject to a minimum liquidity requirement (MLR).[3] The initial purpose of the MLR was safety for member institutions [13, p. 1618]. The Omnibus Savings and Loan Bill, passed in 1950, gave the FHLBB the authority to establish a liquidity requirement between four to eight percent of savings balances, the liquidity base. The MLR was initially established at six percent. Savings and loan associations were required to hold at least this percentage of deposits in specified liquid assets.

Effective 1 March 1961 the MLR was increased to seven percent and it remained at this value until 1968. Public Law 90-505, passed in 1968, shifted the emphasis of liquidity requirements from safety to stabilization of the mortgage and housing markets [13]. Since 1968 the MLR has been changed quite often. It has been decreased during periods when the inflow of deposits decreased at SLAs, such as in 1969 and 1973, thus increasing the funds available to SLAs that could be used to supply credit in the mortgage market. When the inflow of deposits increased at SLAs after these tight money periods the MLR has been increased. Table I shows the value of the MLR since 1950, and details the changes in the definitions of the liquidity base and eligible liquid assets that have taken place.

The purpose of this paper is to analyze whether these three policies, the special advances program in 1970, the special advances program in 1974, and changes in the MLR, have affected the supply of mortgage funds by savings and loan associations. Weinrobe analyzed the effects of changes in the MLR and concluded that "both increases and decreases in the minimum liquidity requirement have had no discernible effect on mortgages made by S & L's" [13, p. 1617].

A model of portfolio allocation by savings and loan associations is developed in Section I. Empirical results are presented in Section II, and the study is summarized and conclusions drawn in the final section.

I. The Model

A model of portfolio allocation that is consistent with the balance sheet identity will be developed for savings and loan associations. A version of the balance sheet for SLAs is presented in equation (1):

$$MH + MO + OR + RL = DOL + BO. \tag{1}$$

Four assets are specified for SLAs. The principal asset held by SLAs is home mortgages, MH. Other mortgages, MO, are approximately evenly divided between multifamily mortgages and commercial mortgages. Required liquidity, RL, is equal to the MLR times the liquidity base. The final asset specified is other assets minus required liquidity, OR. This is equal to total financial assets minus home mortgages, multifamily mortgages, commercial mortgages, and required liquidity.

Two liabilities are specified. Borrowings, BO, consist of Federal Home Loan Bank advances, bank loans, and security RP's. This category principally consists

[3] We shall assume that all savings and loan associations are members of the Federal Home Loan Bank System. At the end of 1977 associations that were members held 98.5% of the assets of all savings and loan associations [12, p. 97].

Table 1[a]

Minimum Ratio[1] of Liquid Assets[2] to Liquidity Base[3] Required of Members of the Federal Home Loan Bank System
[Percent]

Effective date	All liquid assets	Short-term liquid assets[4]	Effective date	All liquid assets	Short-term liquid assets[4]	Effective date	All liquid assets	Short-term liquid assets[4]
Dec. 1950	6	([6])	May 1, 1971	7½	([6])	Apr. 1, 1975	5½	1½
Mar. 1, 1961[5]	7	([6])	Aug. 1, 1971	7	([6])	June 1, 1975	6	2
Aug. 1, 1968	6½	([6])	Jan. 1, 1972	7	3	Sept. 1, 1975	6½	2½
June 12, 1969	6	([6])	May 1, 1973	6½	2½	Mar. 1, 1976	7	3
Dec. 1969	5½	([6])	Aug. 1, 1973[7]	5½	1½	May 1, 1978	6½	2½
Apr. 1, 1971	6½	([6])	Sept. 1, 1974	5	1			

[a] Source: FHLBB *Journal*, December 1978, Table S.4.11, p. 43.

[1] Before Dec. 22, 1969, the indicated minimum was required on each day a member closed loans. Beginning Dec. 22, 1969, compliance has been monthly on the basis of an average of daily liquid asset balances to an average of the liquidity based for the preceding month, or, in the case of members with less than $25 million in assets, to the liquidity base at the end of the preceding month. Special provision is made in the case of deficiencies resulting from the withdrawal of savings.

[2] Liquid assets consisted of unpledged cash, deposits, and U.S. Government securities through June 10, 1969. Federal agency securities with 5 or less years to maturity were added June 11, 1969. Effective Dec. 22, 1969, and subject to some additional restrictions, the following were made eligible liquid assets (a) time deposits at commerical banks with a maturity of 1 year or less, or a notice period of 90 days or less; (b) bankers' acceptances with a maturity of 6 months or less; (c) general obligations of State and local governments with a maturity of 2 years or less: (d) eligible liquid assets held subject to a repurchase agreement; and (e) accrued interest on liquid assets, or assets which would so qualify except for maturity. Effective Jan. 1, 1972, the amount of U.S. Government securities with a maturity of more than 7 years that could be counted as liquid assets was limited to one-half of 1 percent of the base and mutual savings banks could elect to hold that portion of required liquidity in excess of 5 percent in Federal funds and commercial paper. Beginning Nov. 21, 1973, unsecured Federal funds loans made eligible liquid assets for member associations. Effective May 14, 1974, maximum maturity for bankers acceptances increased to 9 months. Effective April 1, 1975: (a) maximum maturity for U.S. Government securities reduced to 5 years, except such securities with a longer term held on March 31 and eligible as liquid assets would continue as such through March 31, 1977; (b) certain public housing authority notes guaranteed by the United States with maximum maturity of 24 months made eligible liquid assets.

[3] Before Nov. 1, 1970, the liquidity base consisted of a member net withdrawable accounts (or the policy reserve required by State law, in the case of an insurance company). Beginning Nov. 1, 1970, borrowings payable on demand or due in 1 year or less were added.

[4] Short-term liquid assets consist of the liquid assets defined in footnote 2, except (a) U.S. Governments and Federal agency securities with a maturity longer than 18 months; (b) commercial bank time deposits with a maturity longer than 6 months; (c) State and local government obligations; and (d) bankers' acceptances with a maturity longer than 6 months. Effective April 1, 1975; (a) maximum maturity for the U.S. Government and Federal agency securities reduced to 12 months, except such securities held on March 31 and eligible as short-term liquid assets would continue as such; (b) certain public housing authority notes with a maturity of 6 months or less made eligible liquid assets. The requirement is not applicable to member mutual savings banks or insurance companies.

[5] During the period June 27–Nov. 1, 1966, members were permitted to reduce liquid asset holdings below the requirement by an amount not exceeding the smaller of (a) actual net savings withdrawn, or (b) 1 percent of withdrawable savings.

[6] No separate requirement.

[7] Penalties for liquidity deficiencies caused by net savings withdrawals during August through December 1973 and April through October 1974 were waived.

of advances. The other classification, DOL, is all other liabilities plus net worth. It is equal to total financial assets minus borrowings, BO. Savings shares at SLAs account for most of this category.

The four choice variables for SLAs are MH, MO, OR, and BO.[4] Transforming equation (1) we obtain

$$\text{MH} + \text{MO} + \text{OR} - \text{BO} = \text{DOL} - \text{RL}. \tag{2}$$

Equations will be specified to explain the supply or demand for funds for the four variables on the left hand side of equation (2).

To incorporate the balance sheet identity, a general version of the stock adjustment model is used. The net change in one of these four variables depends on the difference between the desired stock and the amount held in the previous period of not only the variable under consideration but also the other three variables on the left hand side of equation (2). Certain constraint variables, z_k, that will be specified below, also affect the net change in a variable:

$$\Delta x_i = \sum_{j=1}^{4} b_{ij}(x_j^* - x_j(-1)) + c_{ik}z_k,\ i = 1, 2, 3, 4. \tag{3-6}$$

The desired stocks are assumed to have the following form:

$$x_1^* = a_{11}\text{DOL} + a_{12}\text{RL} + a_{13}\text{RMH}\cdot\text{DR} + a_{14}\text{RMO}\cdot\text{DR} + a_{15}\text{ROR}\cdot\text{DR} + a_{16}\text{RBO}\cdot\text{DR}, \tag{7}$$

. . .

. . .

$$x_4^* = a_{41}\text{DOL} + a_{42}\text{RL} + a_{43}\text{RMH}\cdot\text{DR} + a_{44}\text{RMO}\cdot\text{DR} + a_{45}\text{ROR}\cdot\text{DR} + a_{46}\text{RBO}\cdot\text{DR}. \tag{10}$$

RMH is the interest rate on home mortgages, RMO the interest rate on other mortgages, ROR an interest rate representing other assets, and RBO an interest rate representing borrowings by SLAs. All four interest rates are scaled (multiplied) by other liabilities plus net worth minus required liquidity (DR = DOL − RL). Ideally, each interest rate should enter twice, once multiplied by DOL and once by RL. When this was done there were problems with multicollinearity; thus, the interest rate differential is used.

With the borrowings variable measured as a negative quantity in equations (3)–(10) the balance sheet identity implies that:[5]

$$\sum a_{i1} = 1; \tag{11}$$

$$\sum a_{i2} = -1; \tag{12}$$

$$\sum_i a_{im} = 0,\ m = 3, 4, 5, 6; \tag{13}$$

[4] We assume that the quantity of advances is not controlled by the FHLBS. Rather it is determined in the market for advances [7, pp. 137–8].

[5] Swan [11] has developed a model similar to ours, and he used it to explain portfolio allocation by SLAs and other financial institutions. He shows that conditions similar to (11)–(15) hold for portfolio allocation among a set of assets. Extending his analysis to portfolio allocation among assets and liabilities, it can be shown that equations (11)–(15) hold.

$$\sum_t b_{ij} = 1, j = 1, 2, 3, 4; \tag{14}$$

$$\sum_t c_{ik} = 0. \tag{15}$$

Substituting equations (7–10) into equations (3–6) we obtain the equations that are estimated. In matrix notation they can be written as:

$$\Delta X_t = BAY_t - BX_{-1} + CZ_t, \tag{16}$$

where

ΔX = a 4×1 vector of dependent variables,

B = a 4×4 matrix of adjustment coefficients,

Y = a 6×1 vector of independent variables,

A = a 4×6 matrix of structural coefficients,

Z = a $n \times 1$ vector of constraint variables,

C = a $4 \times n$ matrix of coefficients.

The long-run coefficients, the A matrix, can be obtained by inverting the matrix of adjustment coefficients, B, and multiplying the inverted matrix times the short-run coefficients, the BA matrix.

There are certain a priori expectations about the signs of the coefficients in equations (7)–(10).[6] The coefficients of the deposit variable in the asset equations (a_{i1}, $i = 1, 2, 3$) are expected to be positive, with the coefficient in the desired home mortgage equation the largest. The coefficient of the deposit variable in the borrowings equation, a_{41}, is expected to be equal to zero. In each of the equations for the three assets the coefficients for the own interest rate would be expected to be positive, the coefficient for the interest rate for borrowings negative, and the coefficient on the interest rate of other assets could be positive or negative depending on whether the assets are complements or substitutes [10]. Home and other mortgages would be expected to be substitutes. Other assets may possibly be complements with home mortgages and/or other mortgages. In the equation for borrowings, the coefficient on the interest rate for borrowings would be expected to be negative while the coefficients on the other three interest rates would be expected to be positive. The short-run coefficients of the interest rates in BA could be positive, negative, or equal to zero. The values of these coefficients depend on the long-run coefficients and the adjustment coefficients in B.

A forward commitment process is extensively used in the mortgage market [5, 8]. Mortgage commitments affect the timing of mortgage supply. A commitment is made and then taken down at a future date, perhaps more than a year later. There are two alternative ways the commitment process could be taken into account in a model of portfolio allocation. One is to explicitly incorporate

[6] In equations (3)–(16) it has been assumed that the borrowings variable is measured as a negative quantity, and thus desired borrowings, x_4^*, are negative. To simplify the exposition in this paragraph, we shall assume borrowings are measured as a positive variable while discussing the coefficients in equations (7)–(10). Thus x_4^* is assumed to be positive for this paragraph.

commitments. Jaffee [8] in his model of the mortgage market explains commitments, and then a distributed lag on commitments is used in explaining mortgage supply by financial institutions. The determinants of the supply of home and other mortgages specified above would also be expected to be determinants of the supply of commitments.

An alternative approach is to subsume the commitment process into the model of portfolio allocation. The independent variables could be lagged to account for the effects of commitments made in previous periods. Commitments will be discussed further in Section II.

A series of constraint variables are included in the estimated equations. An unexpected change in deposits may affect portfolio allocation by SLAs. The change in deposits, adjusted for liquidity requirements, minus the average change in adjusted deposits for the four previous quarters, CAD, will be used to represent the unexpected change in deposits.

During 1973 and 1974 there were two institutional changes by the Federal Home Loan Bank System that may have affected the portfolio allocation of savings and loan associations. At times during these two years there were: (1) waivers of penalties for deficiencies of required liquidity for savings and loan associations that were having net savings withdrawals; and (2) restrictions on the granting of advances to savings and loan associations that had not decreased their excess liquidity [13]. Two dummy variables, D1 and D2 respectively, will be used to represent these institutional changes.

A dummy variable, DB, is used to represent the special 5-year advances program established in May 1974. Since funds were available at the rate of $500 million per month for the last eight months of 1974 this dummy variable is set equal to ¼ in 1974.2, ⅝ in 1974.3, and the 1 for the remainder of the estimation period (through 1976).

The effect on the stock of advances outstanding from the Specially Priced Advances Program in 1970–1 is expected to be cumulative. The pattern of the effect of the program on advances outstanding depends on what the distribution of advances repaid would have been if the program had not been established. Since what the distribution of advances repaid would have been if the program had not been established is unknown, the four equations will be estimated with the four quarters 1970.2–1971.1 dropped, and then the values for the four dependent variables will be predicted for these four periods. The actual and predicted values will be compared to analyze the effects of the Specially Priced Advances Program.

The MLR affects portfolio allocation in the model presented in several ways. In the four equations required liquidity, RL, is one of the independent variables; other liabilities plus net worth minus required liquidity, DR, is used as a scaling factor for some of the right-hand variables; and in the variable representing the unexpected change in deposits, savings deposits are adjusted for liquidity requirements. The question with respect to the liquidity policy of the FHLBS is whether changes in the MLR have any effect in the mortgage market. In particular, have the decreases in the MLR during periods of credit restraint increased the supply of mortgage funds?

II. Empirical Results

The four equations were estimated, with quarterly data, for the period 1961–76, except for the four quarters 1970.2–1971.1, using ordinary least squares. The data and the sources of the data are described in the data appendix. Variables in dollar terms are in billions of dollars. Interest rates are in percentage points. The flow of funds data used are seasonally unadjusted, so seasonal dummy variables were used for the second, third, and fourth quarters: S2, S3, S4.

There was a major innovation in mortgage financing for income properties in the latter part of the 1960s. An increasing proportion of loans was made with some type of "participation" feature instead of the usual fixed interest rate. There are many types of such features, but the essential characteristic is that some portion of the lender's return is variable in amount rather than being fixed; usually it is a function of some measure of the income of the mortgaged property. Participations are mainly a phenomenon of tight money periods.[7] Participation mortgages provide a higher return than the contract rate on the loan, and the expected return may have been appreciably higher: "(Life insurance companies) would require a fixed interest rate appreciably higher in the absence of the variable feature" [14, p. 33].

A multifamily mortgage rate is used to represent the interest rate on other mortgages in this study. It is the contract rate for new commitments by life insurance companies. These loans include some with participation features [6, p. 22]. This series will not adequately reflect the expected return during periods participations are widely used. A dummy variable will be used to represent the effect of participations during the tight money periods in the estimation period.[8]

Two alternative methods of incorporating the forward commitment process into the model were discussed in the previous section. One is to explicitly incorporate commitments into the model; the other is to implicitly incorporate commitments by lagging independent variables. Both approaches were tested. Various distributed lags on the interest rate variables were tried. Also equations with the outstanding commitments of SLAs explicitly entered were tested.[9] Best results were obtained with commitments entered explicitly, and just commitments from the previous period entered.

Results will be presented initially for the three asset supply equations and for borrowings. Then results will be presented for the supply of commitments. Thus

[7] See Chesborough [2] and Wright [14] for a discussion of the various types of participation features and their importance.

[8] The dummy variable used is one Modigliani has utilized to allow for credit rationing [9, pp. 90–1]. Modigliani's study of credit rationing suggests that a significant increase in credit rationing is accompanied by a substantial narrowing of the spread between the commercial loan rate and short-term market rates, such as the commercial paper rate. A dummy variable is used when this differential exceeds some threshold level.

When the interest rate differential, the commercial paper rate minus the commercial loan rate, is greater than $-.7$, this differential, R is used, plus another dummy variable, J, is set equal to 1. This threshold is exceeded during eight quarters, 1968.4 through 1970.3, in the tight money period in 1969–70, and during four quarters in 1973–4.

[9] Data on new commitments by SLAs are available, but not for a long enough period to be used in this study [3]. The commitment variable used is the level of commitments outstanding.

the results presented initially show only the direct effects on portfolio allocation of the various FHLBB programs and the other determinants of the supply of assets and borrowings. To obtain the full effects the channel through commitments also has to be taken into account.

As was mentioned in Section I an unexpected change in deposits is believed to affect portfolio allocation by SLAs. Since there are restrictions on the assets required liquidity may be invested in, one variable that was used to represent an unexpected change in deposits is the net change in adjusted deposits minus the average net change for the four previous quarters, CAD:

$$\begin{aligned}\mathrm{CAD} = {} & \mathrm{SD}(1 - \mathrm{MLR}) - \mathrm{SD}_{-1}(1 - \mathrm{MLR}_{-1}) \\ & - .25 \sum_{i=1}^{4} [\mathrm{SD}_{-i}(1 - \mathrm{MLR}_{-i}) - \mathrm{SD}_{-i-1}(1 - \mathrm{MLR}_{-i-1})], \quad (17)\end{aligned}$$

where SD is savings deposits of SLAs.

Using CAD assumes that an unexpected change in deposits has the same effect on portfolio allocation as an unexpected change in required liquidity for savings deposits. An alternative model, with CAD partitioned into two components, was also estimated to see if an unexpected change in deposits, CD, does have the same effect on portfolio allocation as an unexpected change in required liquidity for savings deposits, CDM.

$$\mathrm{CD} = \mathrm{SD} - \mathrm{SD}_{-1} - .25 \sum_{i=1}^{4} [\mathrm{SD}_{-i} - \mathrm{SD}_{-i-1}]. \quad (18)$$

$$\begin{aligned}\mathrm{CDM} = {} & \mathrm{SD} \cdot \mathrm{MLR} - \mathrm{SD}_{-1} \cdot \mathrm{MLR}_{-1} \\ & - .25 \sum_{i=1}^{4} [\mathrm{SD}_{-i} \cdot \mathrm{MLR}_{-i} - \mathrm{SD}_{-i-1} \cdot \mathrm{MLR}_{-i-1}]. \quad (19)\end{aligned}$$

Better results, based upon the S.E.'s in the equations, were obtained with CAD divided into its two components, and these are the results that are presented.

The seasonal dummies, D1, D2, J, R, and the interest rates are scaled (multiplied) by DR, other liabilities plus net worth minus required liquidity. The preferred empirical results are presented in Table II and the long-run coefficients in Table III.[10] The direct impact effect of a $1.00 increase in deposits is an increase of approximately $.48 in home mortgages and $.49 in other assets. Borrowings increase by $.16 and the supply of other mortgages by $.18. In the long run the coefficient on DOL is .93 in the home mortgage equation and .08 in the other assets equation. The coefficients on other mortgages and borrowings are both negative. For a specific estimation period such coefficients may be negative. SLA's may be reducing their holdings of some assets [11, pp. 27–8].

Most of the long-run interest rate coefficients have the expected sign. In the home mortgage equation, the coefficient on the borrowings interest rate would be expected to be negative. In the other mortgages equation, the coefficient on the home mortgage interest rate would be expected to be negative. In the borrowings equation, the coefficient on the other mortgages interest rate would be expected

[10] For convenience the results are reported with the borrowings variable a positive quantity in Tables II and III, not equal to a negative quantity as in equations (3)–(16). Therefore, the constraints listed in equations (11)–(15) are obtained by summing the coefficients in the three asset equations minus the coefficients in the borrowings equation. Also the coefficients on BO_{-1} will sum to plus one instead of minus one.

Table II

The Supply of Home Mortgage Funds, Other Mortgage Funds, and Funds for Other Assets, and the Demand for Borrowings, Estimated Coefficients[a]

	MH	MO	OR	BO
DOL	.484	.181	.490	.155
	(4.87)	(2.66)	(3.83)	(0.97)
RL	−.337	−.185	−.672	−.194
	(2.39)	(1.92)	(3.71)	(0.86)
CD	−.262	−.170	.062	−.371
	(2.64)	(2.51)	(0.48)	(2.32)
CD_{-1}	.059	.075	−.140	−.005
	(2.17)	(4.05)	(3.99)	(0.12)
CDM	.267	.129	−.003	.393
	(2.19)	(1.55)	(0.02)	(2.00)
OC_{-1}	.302	.124	−.058	.368
	(3.98)	(2.39)	(0.59)	(3.02)
DB	.600	−.629	2.650	2.622
	(1.51)	(2.31)	(5.16)	(4.09)
D2	−.00344	−.00045	.00884	.00495
	(2.32)	(0.44)	(4.62)	(2.07)
S2	.00806	.00212	−.00105	.00913
	(6.62)	(2.55)	(0.67)	(4.66)
S3	.00639	.00156	−.00221	.00574
	(5.46)	(1.96)	(1.47)	(3.05)
S4	.00533	.00272	−.00100	.00705
	(4.21)	(3.16)	(0.62)	(3.47)
RMH	.00405	−.00214	.00259	.00449
	(3.57)	(2.76)	(1.77)	(2.46)
RMO	−.00402	.00295	−.00091	−.00199
	(3.34)	(3.59)	(0.59)	(1.03)
ROR	.00156	−.00053	.00618	.00732
	(2.44)	(1.21)	(7.50)	(7.00)
RBO	−.00032	−.00016	−.00356	−.00404
	(0.29)	(0.22)	(2.56)	(2.32)
MH_{-1}	−.495	−.178	−.443	−.116
	(5.10)	(2.69)	(3.54)	(0.74)
MO_{-1}	−.557	−.250	−.490	−.297
	(5.69)	(3.75)	(3.90)	(1.89)
OR_{-1}	−.479	−.213	−1.027	−.720
	(3.17)	(2.07)	(5.29)	(2.96)
BO_{-1}	.395	.255	.502	.152
	(3.64)	(3.44)	(3.61)	(0.87)
J	.00280	−.00097	−.00707	−.00525
	(2.47)	(1.25)	(4.87)	(2.89)
R	−.00040	−.00260	−.00240	−.00539
	(0.25)	(2.41)	(1.18)	(2.12)
R^{-2}	.993	.948	.955	.937
S. E.	.216	.147	.277	.347
D. W.	1.66	2.36	2.44	2.53

[a] t-statistics are in parentheses.

Table III

Long-Run Coefficients Based upon Results in Table II

	MH	MO	OR	BO
DOL	.926	−.065	.080	−.059
RL	−.759	1.029	−.386	.884
RMH	.0234	.0064	.0077	.0375
RMO	−.0354	.0002	−.0058	−.0410
ROR	.0003	.0033	.0119	.0155
RBO	.0056	−.0022	−.0062	−.0028
J	.0180	.0119	−.0112	.0187
R	.0359	−.0242	−.0011	.0106

to be positive. Home mortgages and other assets are complements; the coefficients on the other interest rate in these two equations are positive. Other mortgages and other assets may be complements or substitutes, but the coefficients on the other interest rate in these two equations would be expected to have the same sign rather than different signs as obtained. The effects of the dummy variables representing participation mortgages are to increase home mortgages, other mortgages, borrowings, and to decrease other assets in the long run.

The adjustment matrix is derived from the coefficients on the lagged stock terms. The coefficients on all the variables in the adjustment matrix have the expected sign except for the lagged borrowings term in the borrowings equation. This term would be expected to have a negative sign, not a positive sign. The coefficient is relatively low, .15, with a t-statistic of 0.87. The own rate of adjustment is very rapid for other assets. The coefficient obtained is actually slightly greater than one.

The portfolio allocation of SLAs is affected by unexpected changes in deposits. The net change in deposits minus the average net change for the four previous periods was entered in the present period, CD, and it was found that this variable lagged one period, CD_{-1}, also affects portfolio allocation. It takes time to adjust mortgage holdings to unexpected changes in deposits. In the present period, over one third of each dollar of unexpected deposits is used to reduce borrowings. Lending for home mortgages and other mortgages is less because of the repayment of borrowings; there is little effect on other assets. An unexpected increase in deposits in the previous period results in an increase in home and other mortgages in the present period, and a decrease in other assets.

An unexpected increase in required liquidity for savings deposits, CDM, also affects portfolio allocation of SLAs, but only in the present period. When this variable was lagged one period, it was not significantly different from zero in any of the four equations. When CDM increases by one dollar, borrowings increase by \$.39 and this increase in borrowings is invested in the mortgage market.[11]

[11] Changes in CDM can occur because of a change in savings deposits or a change in the MLR. Using the formula

$$\Delta(AB) = AB - A_{-1}B_{-1} - AB_{-1} + AB_{-1} =$$

$$A(B - B_{-1}) + B_{-1}(A - A_{-1}) = A\Delta B + B_{-1}\Delta A, \quad (20)$$

Outstanding commitments, OC, influence the portfolio allocation of SLAs. Holding everything also constant a one dollar increase in lagged commitments results in a $.30 increase in home mortgages and a $.12 increase in other mortgages. These increases are financed principally by an increase in borrowings.

Two institutional changes by the Federal Home Loan Bank System during 1973 and 1974 were mentioned in Section I. At certain times during these two years there were waivers of penalties for deficiencies of required liquidity for SLAs that were having net savings withdrawals. The dummy variable representing this change, D1, would be expected to have a negative coefficient in the other assets equation; and it would affect the portfolio allocation of home mortgages, other mortgages, and borrowings with the result that the sum of the coefficients in the three asset equations minus the coefficient reported in the borrowings equation would equal zero. The coefficient on this variable was not significantly different from zero in any of the four equations.

The other institutional change in 1973–4 was that during certain periods there were restrictions on advances to SLAs that had not reduced excess liquidity. The dummy variable representing this institutional change is D2. This program would be expected to reduce advances but the effects in the model presented are uncertain. Advances are only one component, although the major one, of borrowings, BO. Advances could decrease and other borrowings increase to offset this; therefore there would be no effect in the four equations.

This restriction on advances influenced the portfolio allocation of SLAs but most likely not in the manner expected. An apparent purpose of the policy was to reduce holdings of other assets. This did not occur; the coefficient is positive in the other assets equations. The coefficient on D2 is also positive in the borrowings equation.

One would expect a seasonal pattern to the supply of mortgage funds, with the supply of funds being the smallest in the first quarter. This was found for both home and other mortgages. The seasonal supply of mortgage funds is met primarily through borrowings, not reductions in other assets.

Two special advances programs were discussed at the beginning of this paper. The program of advances at a reduced interest rate established in 1974, represented by the dummy variable DB, resulted in a net increase of $2.6 billion in borrowings. However, over $2.6 was invested in other assets. There was an increase in home mortgage funds supplied but other mortgages decreased by more than home mortgages increased.

Table IV presents the actual minus the predicted values of the dependent variables for the four equations for the four periods that the Specially Priced

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equation (19) was partitioned into two components:

$$\text{CDM1} = SD(\text{MLR} - \text{MLR}_{-1}), \tag{21}$$

and

$$\text{CDM2} = \text{MLR}_{-1}(SD - SD_{-1}) - .25 \sum_{i=1}^{4} [SD_{-i} \cdot \text{MLR}_{-i} - SD_{-i-1} \cdot \text{MLR}_{-i-1}]. \tag{22}$$

The system of equations was estimated with CDM1 and CDM2 replacing CDM to test whether a change in the MLR is treated comparably to an unexpected change in deposits in the present period. The results in this alternative model are comparable to those presented in Table II. The results in Table II are the better results, based upon the S.E.'s of the equations.

Table IV

Actual Minus Predicted Values of Dependent Variables for the Four Quarters the Specially Priced Advances Program was in Effect

	MH	MO	OR	BO
1970.2	.044	.116	−.256	−.096
1970.3	.412	−.221	.136	.327
1970.4	1.210	−.087	.087	1.210
1971.1	.549	−.278	2.950	3.222

Advances Program would be expected to influence the portfolio allocation of SLAs. As expected, the effects on the net change in borrowings in the four quarters are not uniform. Comparing these values with the standard errors of the equations presented in Table II certain inferences can be drawn. In 1970.4 borrowings were approximately $1.2 billion greater than they would have been if the program had not been put into effect. Home mortgages is the asset which appears to have increased because of the program as of this period. In 1971.1 borrowings were approximately $3.2 billion greater because of the program, and in this period it is primarily other assets which appear to have increased as a result of the program.

The general pattern of results obtained for the Specially Priced Advances Program in 1970-1 is consistent with those obtained for the below market interest rate program established in 1974. Borrowing did increase as a result of the program. Home mortgages increased somewhat, but the majority of the increase in borrowings appears to have been invested in other assets such as government bonds.

The countercyclical policy with respect to the MLR followed by the FHLBB since 1968 has affected the mortgage market. Reductions in the MLR when the inflow of deposits has decreased have resulted in an increased supply of mortgage funds. In the results presented in Table II required liquidity affects portfolio allocation in three ways: (1) required liquidity enters the four equations directly; (2) some of the independent variables are weighted by DR, other liabilities plus net worth minus required liquidity; and (3) the unexpected change in required liquidity for savings deposits, CDM, enters the four equations directly. The direct effect of required liquidity is the more important of the first two factors. The coefficient on required liquidity in the other assets equation is quite large, equal to −.67, but the coefficient in the home mortgage equation is −.34, and it is −.19 in the other mortgages equation. The coefficient in the borrowings equation is equal to −.19. As will be shown below the variable CDM is an important determinant of the dynamic response of portfolio allocation to a change in the MLR.

The results presented so far have shown the direct effects of the FHLBB policies, deposits, interest rates, etc. on portfolio allocation of SLAs. To obtain the full effects we must consider the possible influence through commitments.

Commitments are used for the gross flow of mortgage loans, not just the net change in mortgages. Therefore the variables used to explain outstanding commitments are the independent variables used to explain the net change in home

mortgages and other mortgages, and also mortgage repayments. Mortgage repayments are defined as total mortgage loans made (the gross mortgage flow) minus the net additions to the stock of mortgages (the net mortgage flow).[12]

Empirical results are presented for the supply of commitments in Table V.[13] The equations were estimated, with quarterly data, for the period 1961–76, except for the four quarters 1970.2–1971.1, using ordinary least squares. Repayments is not one of the explanatory variables in the equations presented in Table V. When repayments is included its coefficient is inexplicably negative (with a t-statistic greater than two).[14] The dummy variable D1, representing waivers of penalties for deficiencies of required liquidity for SLAs which were having net savings withdrawals, and CD_{-1} did not have coefficients significantly different from zero, and have been dropped.

In Table II we saw that the direct effect of the special advances program in 1974 was to increase borrowings by $2.6 billion, but that other assets increased by more than $2.6. In equation (5-1) the coefficient of the dummy variable representing this program, DB, is not significantly different from zero, and thus DB is dropped in equation (5-2). In equation (5-2) the t-statistics for the interest rate variables are relatively low, so in equation (5-3) the interest rates plus the participation dummies are dropped.

The two special advances programs had little direct effect on the supply of mortgage funds. Incorporating the indirect effect through commitments does not modify that conclusion. To see if the Specially Priced Advances Program in 1970-1 affected the supply of mortgage funds through commitments, the value of commitments was predicted for the four quarters, 1970.2–1971.1, that were dropped from the estimation period. The actual minus the predicted values of commitments for these four quarters for equation (5-3) are: .244, .649, .408, and −.041. Two of the four values are less than the standard error of the equation, and the other two are 1.27 and 2.01 times the standard error.

Changes in the MLR were shown above to directly affect the supply of mortgages and in Table V it can be seen that there is also an effect through the commitment process. The coefficient on required liquidity, RL, in equation (5-3) is −.58. A reduction in the MLR increases the supply of commitments and an increase in commitments increases the supply of mortgage funds. To investigate the total effect of a reduction in required liquidity, a simulation experiment was carried out using the system of five equations estimated, the four in Table II and equation (5-3).

During the tight monetary conditions in 1973–4 the MLR was reduced from seven percent to five percent (see Table I). The simulation experiment analyzes the effects of this reduction in the MLR. Two dynamic simulations of the model were performed, and the results compared. First, a dynamic simulation of the system of five equations was executed over the period 1972.1 to 1976.4. Through-

[12] This is the definition used by Jaffee. Also see Jaffee for a detailed development of an equation for the supply of outstanding commitments. Our equation is similar to Jaffee's except he does not impose the balance sheet constraint in his model.

[13] As in Tables II and III the results are reported with the borrowings variable a positive quantity.

[14] In Jaffee's equation for the supply of outstanding commitments by SLAs repayments is one of the explanatory variables but the coefficient is constrained to be positive, it is not estimated. Weinrobe also estimates a commitment equation but he does not include repayments as an explanatory variable.

Table V

The Supply of Total Mortgage Commitments, Estimated Coefficients[a]

	5-1	5-2	5-3
DOL	.578	.605	.501
	(3.96)	(4.47)	(4.27)
RL	−.605	−.641	−.575
	(3.01)	(3.44)	(3.22)
CD	−.333	−.366	−.307
	(2.24)	(2.75)	(2.52)
CDM	.618	.671	.641
	(3.40)	(4.53)	(5.08)
OC_{-1}	.618	.612	.656
	(5.75)	(5.78)	(6.88)
DB	−.303		
	(0.51)		
D2	−.00512	−.00494	−.00326
	(2.33)	(2.30)	(2.71)
S2	.00187	.00210	.00118
	(1.03)	(1.20)	(0.84)
S3	−.00376	−.00369	−.00493
	(2.17)	(2.15)	(3.33)
S4	−.00416	−.00405	−.00573
	(2.20)	(2.18)	(3.71)
RMH	.00113	.00116	
	(0.76)	(0.79)	
RMO	−.00228	−.00224	
	(1.26)	(1.25)	
ROR	.00109	.00113	
	(1.13)	(1.19)	
RBO	.00111	.00113	
	(0.72)	(0.74)	
MH_{-1}	−.580	−.603	−.499
	(4.07)	(4.50)	(4.32)
MO_{-1}	−.485	−.509	−.375
	(3.35)	(3.78)	(3.69)
OR_{-1}	−.668	−.727	−.585
	(2.96)	(3.78)	(4.09)
BO_{-1}	.526	.543	.427
	(3.23)	(3.44)	(3.26)
J	.00104	.00085	
	(0.63)	(0.54)	
R	−.00039	−.00031	
	(0.17)	(0.13)	
R^{-2}	.995	.995	.995
S. E.	.324	.322	.322
D. W.	2.47	2.45	2.32

[a] t-statistics are in parentheses.

out this simulation the exogenous variables are fixed at their actual historical values. The lagged endogenous variables are set at their historic values for the initial period. Solution values are generated for succeeding quarters for the endogenous variables, using the exogenous variables and the previously generated lagged endogenous variables. This experiment is referred to as the standard simulation of the system.

The standard simulation tracks the actual values of the endogenous variables quite well. The ratios of the root mean squared error of the simulation to the mean of the actual stock series for the variables are: 0.1 percent for home mortgages, 0.3 percent for other mortgages, 0.7 percent for other assets, 1.7 percent for borrowings, and 2.4 percent for commitments.[15]

The second simulation is performed similarly to the standard simulation except that the MLR is left at seven percent throughout the period 1972.1 to 1976.4. Thus the effects of the reduction in the MLR can be determined by comparing the time paths of the endogenous variables in the two simulations.

The first seven columns of Table VI present the results of this simulation experiment. Results are presented for the period 1973.2, the first quarter the MLR was reduced below seven percent, to 1975.4. In 1976.1 the MLR was increased to seven percent. In the second column the value of the MLR is given. In the third column the decrease in required liquidity as a result of the reduction in the MLR below seven percent is presented. Since the balance sheet constraint was imposed in the estimation of the model, the sum of the effects in the four equations must equal the reduction in required liquidity. Therefore, the percentage allocations of the reduction in required liquidity are presented in columns (4)–(7).

Taking one row as an example, we see that in 1974.1 the MLR was five and one-half percent. From the reduction in the MLR from seven percent to five and one-half percent required liquidity was $3.632 billion less. As a result of this change, home mortgages were $.135 billion greater. This is 3.7 percent of the $3.632 in additional funds available to SLAs from the reduction in the MLR. Also as a result of the reduction in the MLR borrowings were $1.618 *less*; thus 44.5 percent of the available funds were used to reduce borrowings.

Reductions in the MLR did increase the supply of mortgage funds, but it was not until the fifth quarter after the MLR had been decreased, 1974.2, that over 20 percent of the additional funds available had been invested in the mortgage market. An important determinant of the dynamic response of SLAs to changes in deposits and the MLR is that unexpected changes in these two variables affect portfolio allocation of SLAs.

In Table II the coefficient on required liquidity, RL, is −.34 in the home mortgage equation, yet in Table VI we see that only 9 percent of the reduction in required liquidity is invested in home mortgages in 1973.2. This is because unexpected changes in required liquidity for savings deposits, CDM, influence portfolio allocation. A reduction in required liquidity of one dollar increases home mortgages supplied by $.34 through the direct influence of RL. But this reduction in required liquidity reduces CDM (see equation (19)), and a substantial proportion of the effect through RL is offset.[16]

In 1973–4 the MLR was reduced in a series of steps. The results presented in

[15] A data appendix comparing the results of the dynamic simulation and the actual values for the five equations is available from the author upon request.

[16] SLAs have been given little advance notice of changes in the MLR. Information is given concerning the dates when changes in the MLR have been adopted, and when they have become effective in the *Regulations, Rulings, and Opinions* section of the *Federal Home Loan Bank Board Journal.* Increases in the MLR have been announced approximately one month before they have become effective. Decreases in the MLR typically have become effective when published in the *Federal Register*, usually about a week after they are adopted by the FHLBB.

Table VI

Effects of Reduction in the MLR Below Seven Percent

Period	MLR	Reduction in Required Liquidity (Billions)	Allocation of Column (3)				MLR	Allocation of Funds	
			MH	MO	OR	BO		MH	MO
1973.2	6.5%	$1.139	9.0%	6.4%	70.3%	14.3%	6.0%	9.0%	6.4%
1973.3	5.5	3.445	6.7	6.1	65.1	22.1	6.0	1.7	5.9
1973.4	5.5	3.524	1.9	6.4	51.5	40.2	6.0	2.5	7.0
1974.1	5.5	3.632	3.7	7.5	44.3	44.5	6.0	7.8	9.2
1974.2	5.5	3.678	10.9	10.4	40.1	38.5	6.0	16.8	13.2
1974.3	5.0	4.919	16.1	12.4	45.8	25.7	6.0	21.0	16.2
1974.4	5.0	5.017	16.2	14.4	41.3	28.1	6.0	21.3	18.3
1975.1	5.0	5.231	14.8	15.5	39.8	29.9	6.0	18.2	19.0
1975.2	6.0	2.748	19.9	26.6	8.9	44.7	6.0	15.0	19.2
1975.3	6.5	1.422	44.4	51.7	−23.7	27.5	6.0	11.7	19.3
1975.4	6.5	1.469	44.7	52.6	8.1	−5.4	6.0	8.6	19.2

the first seven columns of Table VI, therefore, do not show the dynamic response to a one time change in the MLR. To show this pattern, a second policy dynamic simulation was performed. For the period 1973.2 to 1975.4 a dynamic simulation similar to the two described above was performed with the MLR set at six percent. The results from the simulation were compared with the results from the previous simulation where the MLR was set at seven percent. In column (8) of Table VI the value of the MLR is given. In columns (9) and (10) the percentages of the additional funds available to SLAs from the reduction in the MLR from seven to six percent that were invested in home mortgages and in other mortgages are given.

The same general pattern of results as in the first section of Table VI is apparent. Reductions in the MLR do affect the supply of mortgage funds, but it is not until over a year after the MLR is reduced that over seventeen percent of the funds made available by the reduction in the MLR are placed in the mortgage market.[17]

[17] In the introduction we quoted from a paper by Weinrobe in which he analyzed the effects of changes in the MLR. Weinrobe did not find any effect on the supply of mortgages by SLAs from changes in the MLR. In his study Weinrobe used monthly data from the period February 1971 through October 1975. Two major differences between our study and Weinrobe's are: (1) he used the total supply of mortgages by SLAs; and (2) he did not impose the balance sheet constraint.

Using our data and estimation period we estimated a series of equations for the total supply of mortgage funds to see if we could find out why our results are different from Weinrobe's. Aggregating home mortgages and other mortgages and estimating an equation for the supply of total mortgages that is specified similarly to the equations in Table II does not affect our conclusion. In this aggregate model changes in the MLR affect the supply of mortgage funds.

Thus, the apparent reason for the difference between our results and Weinrobe's is the specifications of the two models. We found that there are three factors that account for the difference in the results with respect to the MLR between the two specifications, using our data and estimation period. Each individually is not capable of accounting for the difference, but jointly they do.

One is that we impose the balance sheet constraint and Weinrobe does not. The second and third factors are constraint variables that are used in the two models. As a constraint variable, Weinrobe uses the moving average of the net savings gain at SLAs during the five previous months. To represent this variable in our model we used the average net savings gain during the present and previous

III. Summary and Conclusions

In recent years the FHLBB has used two types of policies to reduce the large fluctuations in the supply of mortgage funds: special advances programs at reduced interest rates, and changes in the minimum liquidity requirement. In 1970 and again in 1974 special advances programs were established. In both periods most of the net increase in borrowings was not lent in the mortgage market; rather it was invested in other assets such as government bonds.

Reductions in the minimum liquidity requirement have increased the supply of mortgage funds, but it is not until a year after the minimum liquidity requirement is reduced that substantial effects are felt in the mortgage market.

Data Appendix

The basic source of data is the flow of funds accounts of the Federal Reserve System.

BO—Borrowings of SLAs. Advances plus bank loans plus security RPs.

CAD—Unexpected change in adjusted deposits. Net change in deposits adjusted for liquidity requirements minus average net change in adjusted deposits in four previous periods.

CD—Unexpected change in deposits. Net change in total deposits in the period minus average net change in four previous periods.

CDM—Unexpected change in required liquidity for savings deposits. Net change in required liquidity for savings deposits minus average net change in four previous periods.

D1—A variable equal to 1 in quarters during which penalties for liquidity deficiencies caused by net savings withdrawals were waived (1973.3, 1973.4, 1974.2, 1974.3), and 0 at all other times.

D2—A variable equal to 1 in quarters during which there were restrictions on advances so that SLAs had to draw down excess liquidity to obtain advances (1973.2, 1973.3, 1974.2), and 0 at all other times.

DB—Dummy variable representing the below-market-rate advances program established in 1974. Equal to ¼ in 1974.2, ⅝ in 1974.3, and 1 during remainder of estimation period.

DOL—Total financial assets of SLAs minus BO.

DR—DOL-RL.

J—Dummy variable representing effects of participation mortgages on income properties. Equal to 1 when R is not equal to 0.

MH—Home mortgages of SLAs.

MLMADE—Total mortgage loans made. Source: U. S. Federal Home Loan Bank Board, *Savings and Home Financing Source Book.*

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quarters. The third factor is the constraint variables that we used to represent the unexpected change in deposits at SLAs, CD, and the unexpected change in required liquidity for savings deposits, CDM.

Starting with our aggregate equation specified similarly to Weinrobe's, if we drop the average net savings gain during the present and previous quarters, add CD and CDM, and add the additional lagged dependent variables and interest rates from the imposition of the balance sheet constraint, then the coefficient on required liquidity is negative and significantly different from zero.

MLR—Minimum liquidity requirement of members of the FHLBS. See Table I.

MO—Multifamily mortgages plus commercial mortgages of SLAs.

OC—Outstanding commitments of SLAs. Source: U. S. Federal Home Loan Bank Board, *Selected Balance Sheet Data* and *Federal Home Loan Bank Board Journal.*

OR—Total financial assets minus home mortgages, multifamily mortgages, commercial mortgages, and required liquidity.

R—Dummy variable representing effects of participation mortgages on income properties. Equal to value of commercial paper rate minus commercial loan rate when this differential is greater than −.7, and 0 at all other times.

RBO—Interest rate on advances by the Federal Home Loan Bank of San Francisco. Data provided by the Federal Home Loan Bank of San Francisco.

REP—Mortgage repayments. Equal to MLMADE minus the net change in MH and MO.

RL—Required liquidity. Equal to MLR times liquidity base. Values for the MLR, and the definition of the liquidity base, are given in Table I.

RMH—Home mortgage rate. Effective interest rate on conventional first mortgage loans originated by major types of lender on new single-family homes. Source: 1961-2—*New Series on Home Mortgage Yields Since 1951* by Jack M. Guttentag and Morris Beck; 1963-76—Federal Home Loan Bank Board.

RMO—Interest rate on mortgage commitments of $100,000 and over made by 15 life-insurance companies on conventional apartments. Data provided by American Council of Life Insurance.

ROR—Interest rate on U.S. Government notes and bonds maturing in 3 to 5 years. Source: *Federal Reserve Bulletin.*

S2—Seasonal dummy. Equal to 1 in second quarter.

S3—Seasonal dummy. Equal to 1 in third quarter.

S4—Seasonal dummy. Equal to 1 in fourth quarter.

SD—Savings shares of SLAs.

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