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Author(s): Mark J. Flannery and Christopher M. James
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The Effect of Interest Rate Changes on the Common Stock Returns of Financial Institutions

MARK J. FLANNERY and CHRISTOPHER M. JAMES*

ABSTRACT

This paper examines the relation between the interest rate sensitivity of common stock returns and the maturity composition of the firm's nominal contracts. Using a sample of actively traded commerical banks and stock savings and loan associations, common stock returns are found to be correlated with interest rate changes. The co-movement of stock returns and interest rate changes is positively related to the size of the maturity difference between the firm's nominal assets and liabilities.

THE RELATION BETWEEN interest rate movements and common stock returns has been the focus of a considerable amount of research in recent years. Empirical research has found that inclusion of an interest rate factor adds substantial explanatory power to the simple single-factor market model, where the return on an index of common stocks is used as a proxy for the market portfolio (see, for example, Folger et al. [10] and Fama and Schwert [7]). However, a common deficiency of empirical research in this area is that no specific hypotheses are presented to explain why the effect of interest rate movements on common stock returns should vary among stocks.[1]

In this paper, we examine whether the interest rate sensitivity of common stock returns is related to the maturity composition of the firm's holdings of nominal contracts. We draw on recent research concerning the relation between inflation and stock returns to provide a theoretical rationale for why the interest rate sensitivity of a firm's common stocks should be related to the maturity composition of the firm's nominal assets and liabilities. The empirical relation between the interest rate sensitivity of common stock returns and the maturity composition of nominal contracts is examined for a set of actively traded commercial banks and stock savings and loan associations (S&Ls). These firms

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[1] Inclusion of interest rates as a separate factor can be justified by specifying an intertemporal capital asset pricing model, where the investment opportunity set is permitted to vary and the level of interest rates describes changes in the opportunity set (see Merton [16]). Fama and Schwert [7] analyze the relation between asset returns and interest rates where interest rates are assumed to reflect expected inflation.

were chosen because of the detail and consistency with which the maturity of their assets and liabilities is reported. We find that the common stock returns of these firms are highly correlated with interest rate changes. Moreover, the co-movement of bank stock returns with interest rate changes is found to be positively related to the size of the maturity difference between the bank's nominal assets and liabilities. Our results are consistent with the hypothesis that cross-sectional differences in the interest rate sensitivity of common stocks result, in part, from differences in the maturity composition of the firm's nominal assets and liabilities.

The paper is organized as follows. Section I derives a relation between the maturity composition of a firm's balance sheet and the co-movement of its stock returns with interest rate changes and provides a statement of the hypothesis to be tested. Section II describes the methodology used to estimate interest rate sensitivity, our data, and sample selection procedures. Interest rate sensitivity estimates for commercial banks are presented in Section III. Section IV presents evidence that the interest rate sensitivity of a firm's common stock is related to the maturity composition of the firm's nominal assets and liabilities. The final section contains a brief summary of our results.

I. The Relation Between Interest Rates and Common Stock Returns

To examine the effect of interest rate changes on common stock returns, it is useful to consider the nominal return of a firm's common stock as consisting of two components: (1) the return on nominal assets and (2) the return associated with real or physical assets (liabilities, excluding equity, can be viewed as negative assets). Nominal assets are simply assets with cash flows that are fixed in nominal terms (for example, accounts receivable, most contracts, debt, and certain input contracts), while the cash flows generated by real assets fluctuate with the price level. In general, we may write

$$\tilde{R}_{jt} \equiv \gamma_j \tilde{R}_{jt}^N + (1 - \gamma_j)\tilde{R}_{jt}^P \tag{1}$$

where

$\tilde{R}_{jt}$ = nominal return on the common stock of firm j at time t
$\tilde{R}_{jt}^N$ = nominal return on the nominal assets held by firm j at time t
$\tilde{R}_{jt}^P$ = nominal return on the real assets of firm j at time t
γ_j = net nominal assets held by firm j as a proportion of total assets.

In words, the nominal return on the stock of the j^{th} firm at time t is defined as a weighted average of the returns on the firm's nominal and real assets.

The nominal contracting hypothesis postulates that a firm's holdings of nominal assets plays an important role in explaining the behavior of common stock returns through the redistributive effects of unanticipated inflation and unanticipated changes in expected inflation.[2] Since unanticipated inflation *ceteris*

[2] French et al. [11] were the first to describe the nominal contracting hypothesis as we do here. Christie [1] examines the relation between interest rate changes, variance in stock returns, and firm value within the context of the nominal contracting hypothesis. Christie finds a positive relation between interest rates and volatility of stock returns (and therefore a negative relation between interest rates and firm value).

paribus affects the real value of nominal but not real assets, stockholders of firms with fewer nominal assets than nominal liabilities should benefit from unexpected inflation, while if nominal liabilities are less than nominal assets the value of equity should decline with unexpected inflation. Unexpected changes in *expected* inflation will affect the nominal (as well as real) value of nominal contracts through the effect of changes in expected inflation on the nominal interest rate used to discount the cash flows. The effect of changes in expected inflation on the value of nominal assets and liabilities will vary directly with the term to maturity of the nominal contract.[3] The effect of an unanticipated change in expected inflation on the value of equity will be greater, therefore, the longer the maturity of the firm's nominal assets relative to its nominal liabilities (see Grove [12]).

If, as Fama [3, 4], Fama and Gibbons [6], and Nelson and Schwert [17] argue, movements in the term structure of interest rates (i.e., unanticipated changes in the level of interest rates) result primarily from changes in inflationary expectations, then the nominal contracting hypothesis implies a relation between common stock returns and interest rate changes. In particular, the interest rate sensitivity of a firm's common stock returns will depend upon the firm's holdings of net nominal assets (γ_j) and the maturity composition of net nominal assets held. The higher the proportion of the net nominal assets and the longer the maturity of net nominal assets held, the more sensitive should be the firm's common stock returns to interest rate changes.[4] For example, as interest rates change, the common stock returns of a firm financed entirely by equity and holding only nominal assets should behave exactly like a bond with a maturity equal to the average maturity of the firm's assets. To summarize, the nominal contracting hypothesis predicts that cross-sectional variation in the effect of unanticipated interest rate changes on stock prices should be related to differences in balance sheet composition.

Testing the nominal contracting hypothesis requires detailed balance sheet information concerning the proportion of net nominal assets held (γ_j) and the maturity composition of nominal contract holdings. Sufficiently detailed balance sheet information to test this hypothesis is generally not available for nonfinancial firms.[5] However, commercial banks are required to provide federal regulators with detailed information concerning the maturity compositions of their assets and liabilities. Since commercial banks hold assets and liabilities consisting almost entirely of nominal contracts, we need not be concerned with cross-sectional variations in γ_j and can focus instead on the relation between the

[3] As demonstrated by Hopewell and Kaufman [14], the effect of changes in the level of interest rates on the value of a bond will depend upon the duration and not the maturity of the bond. For simplicity, we assume in the following discussion that nominal contracts have a single risk-free payment at maturity so that duration and maturity are identical.

[4] It is important to note that the maturity composition of nominal assets will affect the interest rate sensitivity of equity regardless of whether the change in the level of interest rates results from changes in the expected real interest rate or changes in price expectations. Note also that the maturity composition of real assets will affect interest rate sensitivity only if the expected *real* interest rate changes.

[5] Inadequate data may partially explain the inability of recent studies such as French et al. [11] to find a significant relation for nonfinancial firms among nominal contract holdings, common stock returns, and changes in inflationary expectations.

interest rate sensitivity of stock prices and differences in the maturity of net nominal assets held.[6]

Using a sample of commercial bank stocks, we test an implication of the nominal contracting hypothesis that we call the *maturity mismatch hypothesis.* The maturity mismatch hypothesis postulates that differences in the maturity composition of net nominal assets cause differences in the interest rate sensitivity of common stock returns. (This assumes parallel shifts in the entire term structure.) A testable implication of the maturity mismatch hypothesis is that the effect of a change in the level of interest rates on the equity value of the firm will vary directly with the difference between the average maturity of the firm's nominal assets and liabilities. In particular, for a given unexpected increase in the level of interest rates, an increase in the maturity of net nominal assets should *ceteris paribus* result in a larger decrease in the value of equity.

II. Measuring the Effect of Interest Rate Changes on Common Stock Returns

The procedure we employ to test the maturity mismatch hypothesis is to first estimate the sensitivity of common stock returns to interest rate changes and then examine whether our measure of interest rate sensitivity is related to the maturity composition of the firm's nominal assets. We estimate the following model to measure interest rate sensitivity:

$$\tilde{R}_{jt} = \beta_{0j} + \beta_{mj}\tilde{R}_{mt} + \beta_{Ij}\tilde{R}_{It} + \tilde{\varepsilon}_{jt} \tag{2}$$

where

$\tilde{R}_{jt}$ = the holding period return to the j^{th} stock over the period ending at time t

$\tilde{R}_{mt}$ = the holding period return on an equally weighted portfolio of common stocks over the period ending at time t

$\tilde{R}_{It}$ = the holding period return on an index of constant maturity default-free bonds over the period ending at time t.

The estimated β_{Ij} from Equation (2) provides an unbiased measure of the effect of nominal interest rate changes on the common stock returns of firm j given its relation to the market index. Since the holding period returns on bonds are negatively correlated with changes in the level of interest rates, a positive value for β_{Ij} implies that the firm's market value declines when interest rates rise. The market index $\tilde{R}_{mt}$ in Equation (2) may fluctuate, in part, because of movements in $\tilde{R}_{It}$ and vice versa. To be certain that our findings are not significantly affected by the model as specified in Equation (2), we estimated variations of the model in which the stock market index was first orthogonalized to R_{It}. In all cases, the results using these alternative specifications were qualitatively similar to the results reported here.

[6] For the banks in our sample, real assets (in terms of bank buildings and equipment) averaged less than 2 percent of total bank assets. Equity was less than 6 percent of total assets.

Equation (2) was estimated using weekly return data for the period January 1, 1976 to November 1, 1981. Weekly common stock returns were obtained for a sample of 67 commercial banks from the Data Resources Incorporated (DRI) Security Price File. Banks were included in the sample if they met the following criteria: (1) traded continuously (every week) during the period January 1976 to November 1981, (2) had an identifiable lead bank in the case of multibank holding companies, and (3) the lead bank filed the large bank supplement to the FDIC Call Report during the 1976 to 1981 period. Only banks that traded continuously during the sample period were included to minimize bias in the coefficient estimates arising from infrequent trading (see Dimson [2]). Only bank holding companies with an identifiable lead bank were included in the sample so that balance sheet items obtained from the lead bank's Call Report would adequately reflect the holding company's balance sheet. (For the bank holding companies included in our sample, the lead bank constituted on average 84 percent of the total banking assets of the holding company.) The requirement that the lead bank file the large bank supplement was imposed to obtain sufficient reporting detail about asset and liability maturities.

The equity market index and interest rate indices were also obtained from DRI. The equity portfolio employed in this study was the weekly return on the NYSE composite index. There is no obviously superior interest rate index to use in estimating Equation (2). To avoid changes in the series due to changes in default premia, only indices consisting of U.S. Treasury or U.S. Government guaranteed debt obligations were used. Several alternative interest rate indices were used to check the robustness of our results.

(1) The return on Government National Mortgage Association (GNMA) 8 percent certificates calculated as the weekly holding period return, using the price of the most recently issued GNMA 8 percent certificate at the close of trading on Friday of each week. (Denoted as R_{GNMA}.)
(2) The weekly percentage change in the yield relative on an index of 7-year Treasury bonds. (Denoted as R_{G7}.)[7]
(3) The return on 1-year Treasury bills calculated as the weekly holding period return, using the price of the most recently issued bill at the close of trading on Friday of each week. (Denoted as R_{TB}.)

Descriptive statistics for these series are contained in Part A of Table I.

If these three interest rate indices measure unanticipated changes in interest rates, then the series should be white noise processes. To examine this issue, the autocorrelation functions for each series were estimated using lags of up to 15 weeks. The autocorrelations for lags 1 through 6 are presented in Part B of Table I (lags 4 to 15 were not significantly different from zero). A Box-Pierce Q-statistic

[7] The yield relative is defined as

$$-\left[\frac{Y_t - Y_{t-1}}{Y_{t-1}}\right]$$

where Y_t is the yield to maturity. For long-term bonds the change in the yield relative is approximately equal to the holding period return.

Table I
Interest Rate Indices[a]

A. Descriptive Statistics

Index	Mean Weekly Return	Std. Dev.	Correlation Coefficients R_{GNMA}	R_{G7}	R_{TB}
R_{GNMA}	−0.16%	0.015	1.00	0.746	0.698
R_{G7}	−0.26%	0.021	0.746	1.00	0.794
R_{TB}	−0.018%	0.004	0.698	0.794	1.00

B. Autocorrelation Coefficients

Index	r_1	r_2	r_3	r_4	r_5	r_6	$S(r)$[b]
R_{GNMA}	−0.002	0.068	0.041	−0.024	0.101	0.085	0.06
R_{G7}	0.055	0.133	0.076	0.057	0.047	0.010	0.06
R_{TB}	0.170	0.214	0.200	0.085	−0.001	0.056	0.06

[a] Based on weekly data for the period January 1, 1976 to November 1981.
[b] Standard error of the autocorrelation coefficients.

was used to test whether the autocorrelation coefficients (lags 1 to 15) are jointly different from zero. For the R_{GNMA} series, the autocorrelation coefficients are not either individually or jointly different from zero. On the other hand, for the Treasury bill series, the first three autocorrelations are significantly different from zero (at the 0.01 level). The R_{G7} series is indeterminate; r_2 is significantly different from zero, although the Box-Pierce Q-statistic is not.

To obtain a measure of unanticipated interest rate changes, a third-order autoregressive model (AR(3)) was estimated for each series.[8] Part A of Table II contains the parameter estimates for the AR(3) models. The autocorrelation coefficients for the residuals of the models (reported in Part B) indicate that the residual autocorrelations are small and insignificantly different from zero, consistent with the series being generated by a white noise process.[9] (A series consisting of unanticipated interest rate changes must have this property.) The residuals of these AR(3) models were therefore used as the interest rate indices in estimating Equation (2).[10]

III. Bank Interest Rate Sensitivity Estimates

Table III contains the results of estimating Equation (2) for an equally weighted portfolio of commercial bank stocks. The estimated value of β_I for the portfolio represents the cross-sectional average value of the $\hat{\beta}_{Ij}$. Our results indicate commercial bank stock returns are very sensitive to interest rate changes regard-

[8] An AR (3) model was chosen through inspection of the partial autocorrelation and autocorrelation coefficients associated with the T-Bill series. An AR(3) model was estimated for the R_{GNMA} and R_G series for consistency.

[9] Autocorrelation coefficients were calculated for up to 15-week lags. The magnitude of these coefficients and the pattern are similar to the results reported in Part B of Table I.

[10] Equation (2) was also estimated without whitening the interest rate series. The results obtained are virtually identical to the results reported in Sections III and IV.

Table II

Estimates of Unanticipated Interest Rate Changes

A. AR(3) Model[a]

$R_t = \alpha_0 + \alpha_1 R_{t-1} + \alpha_2 R_{t-2} + \alpha R_{t-3} + U_t$

Index	α_0	α_1	α_2	α_3	$S(U)$[b]
R_{GNMA}	−0.0015	−0.0053	0.0685	0.0425	0.015
	(0.0009)	(0.0587)	(0.0588)	(0.0591)	
R_{G7}	−0.0020	0.0443	0.1261	0.0617	0.021
	(0.0012)	(0.0584)	(0.0583)	(0.0586)	
R_{TB}	−0.0002	0.1138	0.1657	0.1463	0.003
	(0.0020)	(0.0577)	(0.0575)	(0.0578)	

B. Autocorrelation Coefficients

Index	r_1	r_2	r_3	r_4	r_5	r_6	$S(r)$[c]
R_{GNMA}	0.001	−0.002	−0.010	−0.031	0.106	0.083	0.06
R_{G7}	−0.002	−0.006	−0.006	0.042	0.047	0.011	0.06
R_{TB}	0.000	0.013	0.011	0.041	−0.031	0.061	0.06

[a] Standard errors are in parentheses.
[b] Standard errors of the residuals.
[c] Standard error of the autocorrelation coefficients.

Table III

Estimates of Interest Rate Sensitivity for a Portfolio of Commercial Bank Stocks[a]

$\tilde{R}_t = \beta_0 + \beta_m \tilde{R}_{mt} + \beta_I \tilde{R}_{It} + \tilde{\epsilon}_t$

Index[b,c]	$\hat{\beta}_0$	$\hat{\beta}_m$	$\hat{\beta}_I$	$\bar{R}^2$	Durbin-Watson Statistic
R_{GNMA}	0.002	0.556	0.133	0.57	1.74
	(0.001)	(0.030)	(0.038)		
R_{G7}	0.002	0.560	0.069	0.56	1.73
	(0.001)	(0.031)	(0.027)		
R_{TB}	0.001	0.555	0.515	0.57	1.73
	(0.001)	(0.031)	(0.160)		

[a] Estimated using weekly data for the period January 1, 1976 to November 1981, $N = 302$.
[b] Interest rate series are the residuals of the AR(3) models.
[c] Standard errors are in parentheses.

less of the interest rate index employed. Equation (2) was also estimated separately for each of the 67 banks in our sample. Note that the positive coefficients associated with $\tilde{R}_{It}$ indicate an inverse relation between unanticipated interest rate changes and the return on bank stocks. Note also that the value of $\hat{\beta}_I$ associated with the T-Bill index is substantially larger than the value of $\hat{\beta}_I$ obtained using longer term bond series. The difference in the estimates of $\hat{\beta}_I$ result in part from the fact that long-term bond prices respond more to a given change in the level of interest rates than do short-term bond prices.[11]

[11] This finding is consistent with our interpretation of $\hat{\beta}_I$ as a measure of interest sensitivity resulting from maturity mismatch.

IV. Interest Rate Sensitivity and the Maturity Composition of Nominal Contracts

The results obtained from estimating Equation (2) indicate that the returns on bank stocks are highly correlated with interest rate changes. These results are used to examine two testable implications of the maturity mismatch hypothesis. First, if the interest rate sensitivity of bank stocks is related to the maturity composition of net nominal assets, then $\hat{\beta}_{Ij}$ is expected to vary directly with the difference between the average maturities of the bank's nominal assets and liabilities. Second, if Equation (2) is estimated for a set of firms with the same proportion of nominal assets as commercial banks (effectively 100 percent) but with net nominal assets of significantly longer maturity, then the average value of $\hat{\beta}_I$ for these firms is expected to be significantly larger than $\hat{\beta}_I$ estimated for the portfolio of bank stocks.

A. Bank Cross-Section Results

If cross-sectional differences in interest rate sensitivity arise from differences in the maturity composition of nominal assets, $\hat{\beta}_{Ij}$ should be larger *ceteris paribus* the longer the maturity of the bank's net nominal assets. A measure of maturity mismatch was constructed by subtracting the dollar value of liabilities subject to repricing within one year from the dollar value of assets subject to repricing within the same period. This net short asset position is called "Short." By construction, assets and liabilities excluded from this measure are assumed to mature in more than one year. (Reporting requirements of bank regulatory agencies dictate the use of one year as the dividing line between short and long assets and liabilities.) A positive value of Short corresponds to a situation where the bank's short-term assets exceed the value of its short-term liabilities (which implies the value of long-term liabilities exceed the value of long-term assets). A negative value of Short implies that the value of short-term assets is less than the value of short-term liabilities.

While the maturity of most balance sheet items is well-defined, some assets and liabilities could not be sorted unambiguously into the "over one year" or "under one year" category. The most important items in this group were demand deposits, savings (passbook) accounts, time deposits under \$100,000, and cash assets (including Federal Reserve balances, vault cash, demand deposits due from other banks, and cash items in the process of collection). On the one hand, some of these items (savings and demand deposits) can be withdrawn at any time and might therefore be considered short-term and subject to repricing within one year. Alternatively, there exists considerable evidence that these deposit stocks adjust slowly to interest rate changes, giving these items longer effective maturities.[12] In this paper, these items were treated as long-term items and therefore were excluded from our measure of net short assets.[13] The definition of Short

[12] See, for example, Flannery [8] or Hester and Pierce [13]. Deposit rate ceilings also impose the equivalent of a regulatory lag on commercial banks similar in impact to the effect of regulatory lags on utility stock prices (see Keran [15]).

[13] Our definition is consistent with the definition of short assets used in Salomon Brothers' *Quarterly Bank Stock Reports.* Related research [9] also confirms that these items behave as long-term assets and liabilities.

used is: (net federal funds sold + investments maturing in less than one year + floating rate loans + trading account securities + customers' liabilities to the bank for outstanding acceptances) − (domestic and foreign certificates of deposits in excess of $100,000 maturing in less than one year + other liabilities for borrowed money + the bank's liabilities on customers' acceptances outstanding).

To test the maturity mismatch hypothesis, we estimate the following cross-sectional regression:

$$\hat{\beta}_{Ij} + \alpha_0 + \alpha_1\left(\frac{\text{Short}}{\text{MV}}\right)_j + \tilde{\omega}_j \tag{3}$$

where

Short = the j^{th} bank's average net short position over the 1976–81 period
MV = average market value of the j^{th} bank's equity
$\tilde{\omega}_j$ = error term.

An appropriate scale variable is required to put the dollar measure of maturity mismatch in the same units of measurement as our measure of interest rate sensitivity. We therefore deflated Short by the market value of the bank's (or holding company's) common stock outstanding, calculated as the average of 1975 and 1980 year-end market values. (We also deflated by book value of bank equity and obtained similar cross-sectional results.)

Implicit in the estimation of Equation (3) is the assumption that the effect of unexpected interest rate changes on firm value is proportional to the value of Short. The intercept term is intended to capture the effect of factors other than Short on the firm's interest rate sensitivity (which are assumed to be constant across banks). For each bank, we obtained balance sheet data from the March 31 *FDIC Report of Condition* in each sample year. A potential source of error arises because stock price data in many instances are for the bank holding company, whereas Short is computed only for the lead bank. Our sample selection techniques should minimize the effects of this error since our sample of stocks includes only holding companies with a large, well-defined lead bank. Under the maturity mismatch hypothesis the expected sign of α_1 is negative. An increase, for example, in net short-term assets $\left(\frac{\text{Short}}{\text{MV}}\right)$ implies a corresponding decrease in long-term assets and/or increase on long-term liabilities. This change should make equity less negatively correlated with interest rate changes. Since our interest rate indices ($\tilde{R}_{It}$) are negatively correlated with changes in the level of interest rates, an increase in Short should correspond to a smaller value of $\hat{\beta}_{Ij}$.

The cross-sectional regression results are reported in Table IV. Regardless of the rate index employed, a negative and statistically significant relation is found between our measure of bank rate sensitivity and the bank's net short asset position. The positive and significant intercept suggests that even when the bank's net short-term assets are zero (so that short-term liabilities are equal to short-term assets) the bank's market value will fluctuate with interest rate changes. This may result from a mismatch in the maturity of assets and liabilities within the long-term category (over one year). The evidence presented in Table IV therefore supports with the prediction of the maturity mismatch hypothesis

Table IV

Cross-Section Results[a,b]

$$\hat{\beta}_{Ij} = \alpha_0 + \alpha_1\left(\frac{\text{Short}}{MV}\right)_j + \tilde{\omega}_j$$

Dependent Variable	α_0	α_1	$\bar{R}^2$	F-statistic
$\hat{\beta}_{\text{GNMA}}$	0.143	−0.031	0.30	25.17
	(0.018)	(0.006)		
$\hat{\beta}_{\text{G7}}$	0.054	−0.019	0.25	19.10
	(0.013)	(0.004)		
$\hat{\beta}_{\text{TB}}$	0.538	−0.124	0.25	19.43
	(0.083)	(0.028)		

[a] Standard errors are in parentheses.

[b] Estimated using cross-sectional data for 67 banks.

that an increase in the maturity of net nominal assets corresponds to greater interest rate sensitivity of stock prices.[14]

In interpreting our cross-sectional results, several caveats should be made. First, our two-step procedure of estimating interest rate sensitivity for each bank using Equation (2) and then analyzing the cross-sectional relation between $\hat{\beta}_{Ij}$ and the firm's net short position introduces measurement error in our dependent variable in Equation (3). More importantly, since Equation (2) was estimated over the same time period and for firms in the same industry, the errors in estimating (2) may be contemporaneously correlated. This would in turn induce (presumably positive) correlation among the estimates of $\hat{\beta}_{Ij}$ and therefore among the $\tilde{\omega}_j$ in Equation (3). This will result in a downward bias in the estimated variance of $\hat{\alpha}_1$ and consequently an overstatement of significance levels. Since the source of this potential problem is the contemporaneous correlation in residuals associated with estimating Equation (2) across banks in our sample, we estimated for a random sample of 10 of our banks a correlation matrix for the residuals obtained in estimating (2). The average correlation coefficient was 0.11 (not significantly different from zero) with the maximum value being only 0.24 (all but one were positive). Since the pairwise correlation of the errors in estimating Equation (2) appears small, the estimates of β_{Ij} are not likely to be highly correlated, and the loss of efficiency is likely to be small.[15]

[14] To test the structural stability of the model, Equations (2) and (3) were estimated using data for two subperiods: 1976 to January 1979 and January 1979 to November 1981. These subperiods were chosen because certain regulatory changes (such as the introduction of money market CDs) may have significantly changed the effective maturity of certain balance sheet items (e.g., retail time deposits). Using an F-test, we cannot reject the hypothesis of structural stability in Equation (2) over these two subperiods. In addition, estimates of Equation (3) for these subperiods yields results similar to those in Table IV.

[15] Note, however, that a linear combination of the error terms in Equation (2) could be highly correlated with one another even though the pairwise correlations are small. An alternative way to test the maturity mismatch hypotheses would be to utilize a technique similar to the one employed by French et al. [11]. This would involve a one-step estimation procedure of including the Short measure in Equation (2) and estimating the system of 67 time series equations using Zellner's [19] seemingly unrelated regressions technique.

Table V

Estimates of Interest Rate Sensitivity for Stock S&Ls[a,b]

$$\tilde{R}_t = \beta_0 = \beta_m \tilde{R}_{mt} + \beta_I \tilde{R}_{It} + \tilde{\epsilon}_t$$

Index[c]	$\hat{\beta}_0$	$\hat{\beta}_m$	$\hat{\beta}_I$	$\bar{R}^2$	Durbin-Watson Statistic
R_{GNMA}	0.004	1.113	0.474	0.50	1.92
	(0.001)	(0.073)	(0.093)		
R_{G7}	0.004	1.082	0.320	0.49	1.87
	(0.001)	(0.076)	(0.069)		
R_{TB}	0.004	1.094	2.022	0.50	1.84
	(0.001)	(0.074)	(0.414)		

[a] Standard errors are in parentheses.
[b] Estimated using weekly data for the period January 1976 to November 1981, $N = 302$.
[c] Interest rate series are the residuals of the AR(3) models.

A second potential problem arises from the fact that the measurement (sampling) error associated with $\hat{\beta}_{Ij}$ may vary cross-sectionally. This may introduce heteroskedasticity into Equation (3) which would cause inefficient (though unbiased) coefficient estimates. To examine the effect of heteroskedasticity, we re-estimated Equation (3) with a heteroskedasticity correction based on the estimated standard errors of $\hat{\beta}_{Ij}$. The results were very similar to those reported in Table IV.

B. Evidence from an Analysis of Savings and Loan Stocks

We obtained additional evidence in support of the maturity mismatch hypothesis from examining the interest rate sensitivity of stock savings and loan associations. Since substantial evidence exists (see, for example, (3)) that S&Ls are less well hedged than are commercial banks (i.e., S&Ls have longer term net nominal assets), the maturity mismatch hypothesis would predict that the average value of $\hat{\beta}_{Ij}$ will be greater for S&Ls than for commercial banks. To examine this question, Equation (2) was estimated for an equally weighted portfolio of 26 actively traded S&L stocks over the period January 1976 to November 1981 using weekly returns. Table V contains the results. As in the case of commercial banks, movements in interest rates are highly correlated with S&L common stock returns (French et al. [11] report similar results). Note also that $\hat{\beta}_I$ is positive, indicating that the market value of S&Ls moves inversely with interest rates. In addition, Equation (2) was estimated for each of the S&Ls individually. The estimated value of $\hat{\beta}_{Ij}$ was positive and statistically significant for all the S&Ls in our sample. A comparison of the coefficient estimates for the interest rate indices for commercial banks, reported in Table III, to the estimates of $\hat{\beta}_I$ for S&Ls indicates that the S&L coefficients are over twice as large as those for commercial banks.

To test formally whether the difference in $\hat{\beta}_I$'s is statistically significant, we employed the following procedure. Equation (2) was estimated simultaneously for the portfolios of S&L and commercial bank stocks using Zellner's [19] seemingly unrelated regression technique. Since the independent variables are the same in both equations, this procedure provides no efficiency gain. However, it does produce an estimate of the covariance of the $\hat{\beta}_I$'s for the bank and S&L portfolios.[16] The estimated covariance was then used in computing the t-statistic to test the difference in coefficients. For the test involving R_{GNMA}, the calculated t-statistic is 5.68, significantly different from zero at the 0.01 level.

V. Summary and Conclusion

Our evidence supports the hypothesis that the effect of nominal interest rate changes on common stock prices is related to the maturity composition of a firm's net nominal asset holding. For commercial bank and S&L stocks, changes in interest rates were found to be significantly related to stock price movements. In addition, cross-sectional variation in the interest rate sensitivity measure is significantly related to the maturity mismatch of the bank assets and liabilities. Consistent with the nominal contracting hypothesis, the maturity composition of nominal contracts is found to be a significant factor affecting common stock returns.

[16] The estimated residuals from (2) for the S&L and bank portfolios are much more highly correlated than the residuals obtained when (2) was estimated for individual stocks. The contemporaneous correlation of residuals for the two portfolios is 0.52.

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