SM-87-7

A Series of Occasional Papers in Draft Form Prepared by Members of the Research Department for Review and Comment

STAFF MEMORANDA

BANK STOCK VALUATION: DOES MATURITY GAP MATTER?

Vefa Tarhan

FEDERAL RESERVE BANK OF CHICAGO

Bank Stock Valuation: Does Maturity Gap Matter?

Vefa Tarhan
Loyola University of Chicago

I have benefited from the comments of Herb Baer, Bulent Gultekin, John Howell, George Kanatas, George Kaufman, Donald Keim, Nick Lash, Mike Smirlock, Paul Spindt, Paul Schultz, Steven Strongin and Timothy Thompson. The Federal Reserve Bank of Chicago provided support for this research. Don Wilson and Linda Hunter provided excellent research assistance.

Bank Stock Valuation:
Does Maturity Gap Matter?

ABSTRACT

The relationship between unexpected interest rate movements and bank stock returns is analyzed in the context of the nominal contracting hypothesis. Unanticipated changes in interest rates should influence individual bank profits and stock returns depending on the maturity characteristics of their assets relative to their liabilities. This hypothesis is investigated by constructing portfolios on the basis of the nominal contracting positions of banks. The main conclusion of this paper is that the wealth redistribution implications of the nominal contracting hypothesis is found to be unimportant in the determination of bank stock returns.

The purpose of this study is to investigate the relationship between the unanticipated movements in interest rates and bank stock prices. As is explained below the relationship in question can be considered a test of the nominal contracting hypothesis for the banking industry.

The unexpected movements in interest rates are measured in two ways. In the first approach, money supply announcement induced interest rate movements are examined. During the last five years there has been an accumulation of evidence pointing out that money announcement surprises cause unanticipated movements in interest rates.[1] By and large, there seems to be a consensus in the literature that there is no relation between the expected component of the money figure announced and interest rates. The response to the unanticipated component, on the other hand, seems to be both prompt (thereby supporting the efficient market hypothesis), and positive (e.g. when money is larger than expected interest rates rise).[2] Thus, examining, the response of bank stock prices to money supply announcements may reveal the sensitivity of bank share prices to unexpected interest rate changes. Alternatively, the unanticipated interest rate movements are captured by the residuals of an interest rate forecasting equation.

This paper is organized as follows: Section I presents the formulation of the nominal contracting hypothesis for commercial banks. Section II discusses the data used in this study. Model specifications as well as the empirical results are covered in Section III. Finally, Section IV summarizes the conclusions of the paper.

I. THE NOMINAL CONTRACTING HYPOTHESIS AND THE COMMERCIAL BANKS

The nominal contracting hypothesis (NCH) has been discussed in relation to the wealth redistribution implications of unexpected inflation. The

hypothesis states that a contract which requires a fixed dollar payment to be made at a specified time will involve wealth redistribution amongest the contracting parties in the event of unexpected inflation. Alchian and Kessel (1959), Bach and Ando (1957), Bach and Stephenson (1974) and Hong (1977), analyze the differences in the stock returns of net debtor and net creditor firms when operating under inflationary conditions. However, these studies do not differentiate between expected and unexpected inflation. Under conditions of market efficiency, only the unexpected component of inflation should involve wealth redistribution amongst the contracting parties. Recently two studies rectified this situation by examining the nominal contracting hypothesis in the context of unexpected inflation (French, Ruback, and Schwert 1983) and Bernard (1986).

In the case of financial intermediaries, the mechanism that triggers wealth redistribution amongst the contracting parties is unexpected interest rate movements. The firms examined in this study are commercial banks. Commercial banks are good candidates for an empirical investigation of the issue at hand since most of their assets and liabilities are nominal in nature. Reasonably detailed data on individual bank balance sheet items is available, which enables the construction of a measure that describes a bank's nominal contracting position. In its function as a financial intermediary, a commercial bank enters into contractual agreements both with its depositors and with the parties that borrow funds from the bank. These contracts are priced in terms of interest rates. Therefore unexpected movements in interest rates can potentially involve wealth redistribution between the bank and its depositors and borrowers. The movements in the unexpected component of interest rates may be the result of revised expectations regarding inflation or be caused by unexpected changes in the real rate of interest. In terms of

the wealth redistribution issue, which of these two factors is the underlying cause of a given unexpected change in the nominal interest rate is unimportant. Thus, while traditionally the nominal contracting hypothesis has been tested in the context of unexpected inflation, when the firms involved are financial intermediaries, unanticipated interest rate movements become the appropriate focus.

Since the relation between money supply announcement surprises and unanticipated changes in interest rates is well documented, one way to test the NCH would be to examine how bank share prices respond to money supply announcements. The primary advantage of this approach is that it enables testing the NCH in the context of an event study. The event in question (money announcements) has attracted substantial attention from the financial markets. Furthermore, the exact timing of the event as well as the market's expectations regarding the figure to be announced is known. The expectations regarding the money figure to be announced is documented by the market participants' response to a survey conducted prior to the announcement. However, one possible problem associated with testing the NCH in the context of money supply announcement induced interest rate changes needs to be pointed out: money supply announcement surprises are only one of the factors that influence unexpected changes in interest rates. Thus, use of this proxy introduces the possibility of measurement errors. To guard against potential measurement errors, unanticipated interest rate movements are also measured directly (as residuals for a daily interest rate forecasting equation), and bank share price response to the residuals are examined. It appears that the results of this study are unaffected by the two different methods of measuring unanticipated interest rates.

The high and volatile interest rates that prevailed in the recent past have fueled interest in the maturity structure of the assets and liabilities of commercial banks. One measure which has been developed to capture the maturity profile of a bank's protfolio is called the maturity gap.[3] Ideally, an interest rate exposure measure should reflect the relative duration of assets and liabilities. However, the lack of sufficiently detailed data (especially for liabilities), requires the use of a relative maturity measure. The gap measure in question is simply the dollar value of the difference between short term assets and liabilities (where short term is typically defined as maturities less than a year). To the extent that there is a positive correlation between the maturity and duration structure of a bank's assets and liabilities, the maturity gap measure will capture the interest rate exposure of one bank relative to another. Thus, under these conditions, ranking banks based on their maturity gaps should be similar to a ranking obtained on the basis of the relative duration of their assets and liabilities.

A bank with a positive gap has a protfolio where the dollar value of its short term assets exceed the dollar value of its short term liabilities. This, of course, means that at the long term end of the maturity spectrum, the value of its liabilities is greater than its assets, a bank with a negative gap obviously has a maturity structure which is the mirror image of a bank with a positive gap.

The activities of a bank can be thought of as a series of nominal contracts between the bank and its borrowers on the one hand, and the bank and its suppliers of funds on the other hand. Two important terms in these contracts are price (interest rate) and maturity. However, as far as the effect of unexpected changes in interest rates on bank profitability, a more

important characteristic than maturity is the frequency with which the assets and liabilities are repriced. A three year, fixed interest loan is a substantially different asset than a three year loan, where the interest rate is calculated daily in relation to the commercial paper rate. Whether or not there will be a wealth distribution between the bank and its customers (both lenders of funds and borrowers of funds) in response to unexpected changes in interest rates will be determined, to a great extent, by the repricing frequency of the assets relative to the repricing frequency of the sources of funds that the bank uses. For example, if the interest rate on both the loan and source of funds for the loan are tied to the commercial paper rate on a daily basis, the bank will earn a spread on the loan, but will not experience any wealth redistribution with either party (borrower and lender) when there is an unexpected change in interest rates.[4] When the repricing terms of a bank's assets and liabilities differ, unanticipated interest rate changes will have wealth redistribution implications between the bank, the agents that provide funds to the bank, and, those who borrow these funds.

Gap management techniques refer to the use of a bank's gap position as a control variable in responding to anticipated interest rate movements. In this regard, a bank that expects interest rates to rise will attempt to shorten the maturity (repricing period) of its assets and lengthen the repricing period of its liabilities. This way, when the expected interest rate change is realized, the bank will be able to reprice its assets at the higher interest rate, while enjoying a lower cost on its source of funds. Thus, a bank with a positive gap should benefit when interest rates rise, while a bank with negative gap (short term assets less than short term liabilities) will experience a decline in profits.

Even though the impact of interest rate changes on the <u>profitability</u> of both positive and negative gap banks is theoretically clear, the effect of

interest rate changes on the share prices of banks with positive gaps is ambiguous. This arises because of the fact that interest rate changes affect all share prices via the capitalization rate investors use in calculating the present value associated with the expected dividend streams. An unexpected increase in interest rates should cause the share prices of banks with negative gaps to decline both because it means a reduced level of expected dividends, and also due to the fact that the stockholders will be discounting the expected dividends at a higher discount rate. For banks with positive gaps on the other hand, higher interest rates mean higher expected profits and dividends, but since the expected dividend stream will be discounted at a higher rate, the net effect on share prices can be determined only empirically.[5]

The banks in this study are classified according to a ranking procedure based on the size (and not sign) of their gap positions. The nominal contracting hypothesis implies that the smaller is the size of a bank's gap the more unfavorable will be the response of its stock price to unanticipated interest rate increases.[6]

By way of preview, the tests conducted in this paper appear to support the conclusion of French, Ruback and Schwert, in that, in the case of banks, the nominal contracting effects are found to be unimportant. This conclusion is contrary to the one reached by Flannery and James (1984). Their result appears to indicate that the gap position of a bank is correlated with the sensitivity of its stock returns to unanticipated interest rates. The approach taken in their study is a two stage procedure. In the first stage, a two factor market model is estimated for individual banks (the two factors are the weekly returns on the NYSE composite index and various measures of holding period returns on an index of constant maturity bonds). In the second stage,

a cross-section regression is estimated where the coefficient on the interest rate factor obtained from the market model is the dependent variable and the gap position of a bank is the independent variable. One implication of a two factor model is that interest rate exposure is a nondiversifiable type of risk which commands a premium. In contrast, the approach taken in this paper does not hinge on the issue of whether or not interest rate is systematic or unsystematic. Instead, the methodology used in this study is agnostic with respect to how interest rate risk is priced. The approach of this paper is somewhat like an events study, in that, portfolios are formed on the basis of the degree of the maturity mismatch position of bank balance sheets, and the response of these portfolios to unexpected interest rate changes is compared. Ex-post, unanticipated interest rates should cause a response in stock returns regardless of whether the risk in question is considered to be systematic or unsystematic. In fact,the evidence presented in this paper shows that bank stock returns are affected by unanticipated changes in interest rates in a statistically significant manner. What is not supported by the results of this paper is the contention that the bank stock reaction to unanticipated interest rates is related to the gap positions of banks.

II. THE DATA AND THE MODELS

A. The Data

The sample period for this study covers the period from February 2, 1979 to October 23, 1982. The information that banks provide in their quarterly call reports is utilized to construct the gap positions. The call report data was provided by the Federal Reserve Bank of Chicago. The total number of banks in this study is 46. The asset and liability items that enter the calculation of the gap measure is exhibited in Table 1.[7] In examining the

relationship between interest rates and bank stock prices, it is assumed that the maturity structure of a bank's assets and liabilities does not change significantly during a 13 week period. Furthermore, it is also assumed that the information revealed in the quarterly call report is representative of a bank's gap position for the 13 weeks centered around the seventh week of a particular quarter. The average market value of a banks equity is used to scale the gap position.[8] In other words, the gap measure used in short term assets minus short-term liabilities as a percent of the market value of a bank's equity.[9]

Table 2 depicts the mean, minimum, and maximum gap position of individual banks for the sample period. It is interesting to note that based on the mean values there are more banks with negative gaps than positive gaps. In fact, there are 9 banks in the sample for which the maximum gap position is negative (while there is only one bank whose minimum is positive). Gap profiles of individual banks over time (which are not reported here) reveal differences in management styles. While there are some banks which almost always have negative gap positions and others with consistently positive gaps, there are others which seem to change their gap positions from quarter to quarter.[10]

The daily stock price and dividends, as well as daily interest rate data used in this study, were provided by the Federal Reserve Bank of Chicago. The Federal Reserve Bank of Chicago obtained the stock price and dividends data from Chase Econometrics. The money supply data used in this study consist of weekly announcements to the changes in money supply, and the market's expectations regarding this figure. The announcements data were obtained from the H6 release of the Federal Reserve System. The Fed releases the weekly forms on Fridays at 4:10 PM EST. The money supply figure that the Fed releases refers to the M1 definition of money prior to February 8, 1980, and,

the M1B definition thereafter. Thus, it is assumed that the changes in M1 and M1B affect bank stock returns in a similar manner. Furthermore, starting on February 8, 1980, the money supply announcement day has been changed from Thursdays to Fridays (starting on February 16, 1984, the Fed switched its announcement day back to Thursdays). Additionally, the announcements are at times irregular due to holidays. Therefore, at times the observation interval is not exactly one week. To measure the response to money supply announcements, bank stock returns are calculated for the business day following the money supply announcements.[11]

Weekly data on the market's expectations regarding the change in money supply were provided by the Money Market Services of San Francisco.[12] Money Market Services has been surveying group market participants on this issue since September 27, 1977. Only the median forecast is released, and this is used as the expected money supply variable.

III. SPECIFICATION OF THE MODELS AND THE EMPIRICAL FINDINGS

Every quarter, the banks in this study are ranked according to the size of their gap positions. On the basis of these rankings, three equally weighted portfolios are formed. The first portfolio includes the 15 banks with the largest gaps, the second portfolio is comprised of the 15 banks that ranked 16-30, and the third portfolio consists of 16 banks ranked 31-46. The ranking process is repeated every quarter and the portfolios in question are revised.

The reaction of these portfolios to money supply announcements is investigated first. Three different tests are performed to analyze this issue. In the first test, the portfolio returns on the days following the money supply announcements are compared to see whether or not the response is related to the gap positions. The second test compares the returns of the

portfolios using a seemingly unrelated regression technique. In the third test, the relation between the reaction of bank stocks and gap positions of banks is investigated by a non parametric approach.[12]

All of these tests are then repeated for the case where the residuals obtained from an ARIMA model of daily interest rates perform as the proxy variable for unanticipated interest rates.

i) Money Supply Announcements

The relation investigated in this section can be specified as:

$$RP_{it} = \alpha_{0i} + \alpha_{1i} (M_t^A - M_t^E) + \alpha_{2i} M_t^E + \alpha_{3i} RETSP500_t + U_{it} \quad (1)$$

Where RP_{it} measures the one day portfolio returns (the day after the money announcement) M_t^A represents the announced change in money and M_t^E is the market's expectation regarding the change in money. Thus, $M_t^A - M_t^E$ measures unanticipated money. $RETSP500_t$ is the one day return (the day after the money announcement) of the S and P 500 index. This variable is included in order to control for the market movements.

The test for the nominal contracting effects amounts to the comparison of the α_{1i} coefficients for the three portfolios. Furthermore, a statistically insignificant estimate for the α_{2i} coefficients will be consistent with the efficient market hypothesis. Market efficiency, in this case, implies that the expected component of the money supply should already be accounted for in the stock returns. The sign of the α_{1i} coefficients could be positive or negative. While, the expected sign of α_{1i} is ambigious for banks with positive gaps, the expected relative magnitude of this coefficient for the three portfolios is clear. If the NCH is to hold it should be the case that $\hat{\alpha}_{11} > \hat{\alpha}_{12} > \hat{\alpha}_{13}$, where portfolio 1 refers to those banks with the largest gap,

while portfolio 3 consists of those with the smallest gap (in fact negative for the sample period used in this study). In other words, since a positive money surprise (the money announced exceeds expectations), results in an upward (unexpected) movement in interest rates, those banks with primarily long term liabilities (portfolio 3) should suffer the most. Banks in portfolio 1 (these banks have relatively more short term assets and long term liabilities) should experience the least drop in their stock prices if the nominal contracting effects are important.

The results from estimating (1) are presented in Table 4. As can be seen from the table, the $\hat{\alpha}_{2i}$ coefficients are statistically not different than zero in all the portfolios, supporting the efficient market hypothesis. The $\hat{\alpha}_{1i}$, coefficients are negative and statistically significant in all the three portfolios. However, the relative magnitude of the estimated coefficients does not seem to support the nominal contracting hypothesis. The table presents the F statistic on the 3 pairwise comparisons of the $\hat{\alpha}_{1i}$, coefficients. The null hypothesis that the pairwise coefficients are the same cannot be rejected in any of the cases. It appears that when money supply exceeds expectations all bank stocks suffer equally regardless of the maturity structure of their assets relative to their liabilities.[13] The $\hat{\alpha}_{3i}$ coefficients are positive and highly significant in all the portfolios. As expected, the portfolio returns appear to be highly correlated with market movements.

An alternative method to test the nominal contracting hypothesis can be constructed by first examining (1).

The crucial relationship in (1) is the comovement of portfolio returns and unanticipated money. The relationship is captured by α_{1i}. In the context of

the nominal contracting hypothesis, α_{1i} is related to the relative size of a bank's assets and liabilities which are sensitive to interest rates, Thus,

$$\alpha_{1i} = \gamma_{0i} + \gamma_{1i} \; GAP_{it}$$

substituting (2) in (1) results in

$$RP_{it} = \alpha_{0i} + \gamma_{0i} (M_t^A - M_t^E) + \gamma_{1i} (M^A - M^E) \; GAP_{it} +$$

$$\gamma_{2i} \; M_t^E + \gamma_{3i} \; RETSP500_t + U_{it} \qquad (3)$$

Equation (3) can be estimated as a system of equations using a seemingly unrelated regression technique, which takes into account the correlation of the error terms across the equations. The results from estimating (3) for the three portfolios are presented in Table 5.[14]

Testing the nominal contracting hypothesis involves comparison of the estimates of α_{1i} for the three portfolios. The average response of the three portfolios to unexpected money can be obtained by

$$\bar{\alpha}_{1i} = \hat{\gamma}_{0i} + \hat{\gamma}_{1i} \; \overline{GAP_i} \qquad (4)$$

where the bar above the GAP variable indicates average values and the coefficients in question are obtained from the estimation of (3). These coefficients are calculated and exhibited in Table 5. It appears that the response of the three portfolios to money surprises is again negative and statistically significant. Based on the F-statistics, the null hypothesis that each coefficient in question is equal to zero is rejected. However, as before, the prediction of the NCH is not fulfilled. The F-statistics on the pairwise comparison of the coefficients are small, making it impossible to reject the null hypothesis that the coefficients in question are not different from one another.

Finally, a more direct method of testing for the nominal contracting hypothesis involves estimating (1) for each individual bank separately. The hypothesis can then be tested by investigating whether or not there is a systematic relation between the estimated α_{1i} coefficients for each individual bank (where α_{1i} measure the reaction of the individual banks' stock returns to unanticipated money), and the average GAP position of each individual bank over the sample period ($\overline{GAPi}$). The Spearman rank correlation between the estimated α_{1i} and $\overline{GAPi}$ shows whether or not the two series are related. A positive correlation coefficient would support the nominal contracting hypothesis, since it indicates that the larger the gap position, the larger is the response of the stock returns to the unexpected component of the money supply announcement. The Spearman rank correlation was found to be negative (-0.03) and statistically insignificant (the tail area of the test is 0.84). Thus, on the basis of this test also, it does not appear that the market takes into account the gap positions of individual banks when it revises its valuation of bank stocks in response to money supply announcement surprises.

It is also interesting to note that the 46 banks for which α_{1i} is estimated, 39 have a negative sign for this coefficient (19 of these are statistically significant at the 5 percent level). Thus, in the case of only 7 banks does unanticipated money produce a positive response (none of these coefficients are significant).

ii) Residuals From and ARIMA Forecasting Procedure and Bank Stock Returns

As mentioned previously, money supply announcement induced interest rates poses the possibility of a problem with measurement errors. To guard against this possibility, all three tests discussed above are repeated for the case

where the unanticipated daily interest rates are measured as the residuals from an ARIMA equation. ARIMA models were fitted on daily 3 month T-bill rates, 6 months T-bill rates and 1 year T-bill rates. The results reported here are only for the 90 day T-bill rates. However, it should be pointed out that all the results obtained for the 90 day bill rate also hold for the other two rates.

For the first test, (1) becomes

$$RP_{it} = \alpha_{0i} + \alpha_{1i} \hat{R}_t + \alpha_{2i} \hat{RES}_t + \alpha_{3i} RETSP500_t + U_t \quad (5)$$

One major difference between (1) and (5) is that in (1) the daily returns of the portfolios were calculated for the day following the money announcements, whereas in (5) the daily returns are calculated for the entire sample period. $\hat{R}_t$ refers to the predicted value of the interest rate series obtained from the fitted equation, while $\hat{RES}_t$ refers to the residuals from the same equation and thus is the proxy for unanticipated interest rates.[15]

The issue being tested again is whether or not the relative size of the coefficients satisfy the following ordering: $\hat{a}_{11} > \hat{a}_{12} > \hat{a}_{13}$. The results of estimating (5) are reported in Table 6. Notice, that the coefficients in question are highly significant and negative as they were in the case of response to money supply announcements. But, more importantly, and as before, the nominal contracting effects are not found. Based on the F statistics, the null hypotheses that the pairwise coefficients are not different cannot be rejected for any of the portfolios. Thus, the conclusion remains, that the unexpected interest rate increases lead the market to revise the share prices of banks downwards. However, as before, in this revision process the market

does not appear to attach significance to the maturity structure of bank assets and liabilities.[16]

Repeating the seemingly unrelated regression procedure for the case where unanticipated interest rates are measured by the residuals transforms (3) to the following equation:

$$RP_{it} = \alpha_{0i} + \gamma_{0i} \hat{RES}_t + \gamma_{1i} \hat{RES}_t GAP_{it} + \hat{\gamma}_{2i} \hat{R}_t + U_{it} \qquad (6)$$

The estimates of (6) for the 3 portfolios as well as the average response of the portfolios is captured by:

$$\bar{\alpha}_{1i} = \hat{\gamma}_{0i} + \hat{\gamma}_{1i} \overline{GAP_i}$$

These coefficients along with the results obtained from the estimation of (6) are reported in Table 7.

The $\bar{\alpha}_{1i}$ coefficients appear to be highly significant on the basis of the value of the F-statistics. In all cases the null hypothesis that $\bar{\alpha}_{1i} = 0$ are rejected. However, the hypothesis that the response is not different amongst the portfolios again cannot be rejected.

The non-parametric test leads to the same conclusion: The Spearman rank correlation between the $\hat{\alpha}_{1i}$ coefficients obtained from the estimation of (5) for the individual banks and their average gap position is -0.013. Based on the tail area of the test (0.90), we cannot reject the hypothesis that there is no relation between the response of bank share prices to unanticipated interest rates and bank gap positions.[17]

iii) Possible Reasons for the Empirical Findings

There are several possible explanations for the results in this paper. One explanation for the fact that the returns of the three portfolios behave

similarly is that there is an industry factor associated with the banking sector which dominates any firm specific factors. It is conceivable that this factor is related to the importance of interest rates for financial institutions. If so, then any event which affects interest rates (e.g. money supply announcements) will result in the market reevaluating the banking sector. In this evaluation the industry factor in question may dominate bank specific factors like the gap position of a bank.

Another possibility is that banks might be well hedged in terms of their interest rate exposure. In other words, it is conceivable that through use of the futures market, interest rate swaps etc. banks offset their interest rate exposure. If so, they will in effect have a zero gap position. The possibility of all the banks being perfectly hedged however, can be questioned on two accounts: First, due to he ambiguity in the accounting treatment of hedging transactions, some banks were reluctant to use the futures market heavily during the sample period considered here.[18] Secondly, the argument does not acknowledge the fact that banks at times actively position themselves to profit from what they perceive to be expected future interest rate movements. Moreover, since there is no reason to think that individual bank interest rate expectations are always homogeneous, their attempts to restructure their balance sheets is likely to result in different degrees of exposure across banks.

These possibly explanations notwithstanding, the evidence presented appears to indicate that in evaluating the impact of unanticipated interest rates, the stock market considers the differences in the maturity structure of banks' assets and liabilities to be unimportant.

IV. SUMMARY AND CONCLUSIONS

This study investigates the relationship between unanticipated interest rates and bank stock returns. The goal of the paper is to test whether or not the statistical relationship observed between stock prices and unanticipated interest rate can be explained in terms of the nominal contracting position of the firms. To this end, the behavior of bank stock returns is analyzed. The main conclusion is that the nominal contracting hypothesis does not appear to be supported by the tests conducted in this study.

It should be pointed out that one would expect the nominal contracting effects to be most important for the type of firms examined in this study, since almost all their assets are nominal in nature. French, Ruback and Schwert (1983) report evidence indicating that the nominal contracting hypothesis is unimportant in explaining the response of stock returns to unexpected inflation.[19] While the disequilibrium condition analyzed here is unexpected changes in interest rates, and not unexpected inflation, the conclusion is similar, in the sense that the wealth redistribution implications of the nominal contracting hypothesis are again found to be unimportant in the determination of stock prices.

It should be pointed out that another study (Flannery and James (1984)) find evidence of nominal contracting effects in the context of the sensitivity of bank stock returns to unanticipated interest rates. The differences between the approaches of the two studies were discussed in the first section of this paper. The contrast between the results of this study and theirs points to the necessity that more work needs to be done in this area. Such future research should continue to examine the issue in the framework of the financial sector, since the balance

sheets of institutions in this industry consist of items which are nominal. For the banking sector, it is found that nominal contracting hypothesis is not supported by the data. That is, while bank stock prices are affected by unanticipated interest rate movements, their responses do not appear to be related to the maturity structure of their assets and liabilities.

Footnotes

[1]During the last six years, the relation between money supply announcements and various interest rates has generated a lot of interest (Cornell (1979), Cornell (1983), Grossman (1981), Roley (1982), Urich and Wachtel (1981). The impact of money supply announcements on the stock market returns (Lynge (1981), Pearce and Roley (1982)) has also been investigated. By and large these studies find that there is a significant relation between unexpected money and the market rates in question. Another finding is that the statistical relationship in question have become more pronounced since October 6, 1979, when the Fed switched to a policy of targeting monetary aggregates.

[2]Two hypotheses are advanced in the literature to explain this relation: the expected liquidity effect, and the inflation premium effect. Paradoxically, the implied behavior of the Fed is drastically different for the two hypotheses in question. The basis for the former hypothesis is that the Fed will abide by its monetary targets and thus offset the surprise component of the announced money supply figure in future periods. The rationale for the latter hypothesis, on the other hand, is that the Fed will "give in" and adjust its monetary targets in the direction of the shock (e.g. increase its targets when actual money supply exceeds the anticipated level).

[3]For alternative measures of the gap position of commercial banks see Flannery and James (1984). the measure used here is same as the one that Salomon Brothers publishes for selective banks.

[4]Maturity and repricing period mean the same thing when the interest rate in question is fixed. However, when the interest rate is variable, the repricing period is the appropriate concept in determining the wealth effects associated with unanticipated interest rate changes.

[5]A decline in interest rates will benefit banks with negative gap positions. The profits of banks in this category will increase since they have long term assets and short term liabilities. This, combined with lower discount rates will imply higher stock prices. The effect of lower interest rates on banks positive gaps is again ambiguous.

[6]It should be pointed out that there is Another factor that reinforces the repricing frequency argument which states that the returns from positive gap bank stocks will be higher than negative gap bank stock returns in the event of any unexpected rise in interest rates. This effect works through the impact of interest rate changes on the market value of a bank's assets. A bank with a positive gap has a smaller portion of its assets that are long term, relative to a bank with a negative gap. Thus, when interest rates rise, other things being equal, a bank with a positive gap will experience a smaller decline in the value of its long term assets than a bank with a negative gap position. Of course in the event of interest rate decreases, banks with a negative gap position will benefit more than positive gap banks, both due to the fact that their liabilities will be repriced at the lower rates, while their assets will not, and also because they have relatively higher volume of long term assets whose prices will increase.

[7]Starting in December 1982, Salomon Brothers has been calculating gap statistics for selective banks in their publication titled "Bank Analysts' Quarterly Handbook." Some of the banks used in this study overlap with the banks in their sample. The Salomon Brothers' definition of the gap measure has been revised a number of times during the last year. The gap measure used in this study is along the lines of their latest definition. I would like to thank Thomas B. Drelles of Salomon Brothers for a detailed discussion on this issue. James and Flannery (JMCB, 1984) investigate whether or not to include demand deposits, passbook accounts, cash assets and retail time deposits in their gap measure. They conclude that the items in question are not truly short term in nature and thus should not be included. I would like to acknowledge the research assistance provided by Debbie Karlowski in the calculation of the gap measures for the sample banks.

[8]The average market value of a bank's equity is defined as the number of common shares outstanding times the average stock price for the 13 week period.

[9]In the case of multibank holding companies, the gap measures were calculated for the lead bank. It is assumed that the gap measure which is constructed for the lead bank is representative of the banking operations of the holding company. The banking assets constituted about 96 percent of the assets of the bank holding companies used in this study.

It should also be pointed out that due to the irregularities in money supply announcement days, there are not always 13 observations in a quarter.

[10]The average gap position for the equally weighted portfolio of banks in the sample was graphed together with various interest rates (3 mos and 1 year Treasury bill rates and the 20 year constant maturity U.S. Government Bond rate). It appeared that for the sample period in question high level of interest rates was correlated with negative gap positions. Reducing the dollar value of short term assets and/or increasing the dollar value of short term liabilities when interest rates increase, is consistent with the belief that interest rates follow a mean reverting process. However, without the benefit of a model of bank interest rate expectation formation, it is not possible to test whether or not banks manager their gap positions in this manner. Nevertheless, this seems to be a plausible explanation as to why bank gap positions became more negative as interest rates rose.

[11]The one day holding period return is defined as

$$RP_t = \frac{P_t - P_{t-1} + D_t}{P_{t-1}}$$

Where p_{t-1} refers to the price of the stock on the day announcement (the stock market is already closed when the announcement is made). P_t is the price of the stock on the first day following the announcement that the market is open, and D_t refers to dividends paid on period t. Trading volume on the stocks in question was not available. This poses a problem, since some of the bank stocks in question had a large number of days with zero returns. One

possibility for zero returns would be no trades. While there was no way to determine the extent of no trading or thin trading, due to the fact that some of the banks in question were relatively small, an attempt was made to eliminate the problems associated with infrequent trading: A particular stock was excluded from the portfolios constructed if its return on the day after the announcement was zero. However, due to the possibility that the zero returns are not the result of infrequent trading, all the analysis in this study was repeated with the data where zero returns are not excluded. The results reported are obtained using the data where zero returns are included in the sample. However, repeating the analysis with data that does not include zero returns produced results which are remarkably similar. In fact these results do not change the conclusions of this paper in any stage of the analysis.

[12]I would like to acknowledge Paul Nicho and Kim Rupert of Money Market Services of San Francisco for making available the survey data in question.

[13]It is conceivable that the quarter-to-quarter changes in a bank's interest rate sensitive assets and liabilities do not reveal the management philosophy of a bank regarding its preferred maturity structure. It may be the case that the market ignores any quarter-to-quarter changes in a bank's gap position, relying instead on the long run equilibrium gap positions in determining banks' stock prices. To remove the potential ambiguity about banks' gap structure, two portfolios were formed were only the banks which have consistently negative or positive gaps were included. The tests conducted in this study were repeated for these portfolios. The results obtained did not alter the conclusions of this appear in any significant manner.

[14]The correlation coefficients across the equations ranged from 0.47 to 0.63. In light of the high correlation coefficients amongst the equations, use of the seemingly unrelated regression method appears to be appropriate.

[15]The ARIMA model was estimated with nonzero AR terms at lags 5, 11 and 22, and moving average term at lag 1. ARIMA models were also fitted for the daily 6 mos and 1 year Treasury bill rates. As indicated above use of 6 mos and 1 year bill rates did not change the conclusions of this study in any manner.

[16]Even though the response of bank stock returns to the forecasted interest rates is significant in the case of two of the portfolios, this does not imply that markets are inefficient. It should be noted that the relative size of the estimated coefficients is something in the order of 1/11th to 1/15th of the response to the unexpected interest rates. Thus, it appears unlikely that investors can make excess profits by trading in bank stocks on the basis of an interest rate forecasting scheme, even without transaction costs considerations.

[17]The estimated α_{1i} coefficients turned out to be negative for 38 of the 46 banks that comprise the sample. None of the 8 positive α_{1i} coefficients were statistically significant.

[18]The ambituity in question refers to the accounting treatment of the fluctuations in the value of the futures contract versus fluctuations in the value of the underlying cash position. Eventually it was ruled that the gains or losses realized as a result of marking to market would be reported on a current basis, while changes in the value of the offsetting cash positions would be reported only when they are accrued.

It should also be pointed out that partially for this reason banks which use the futures market seem to confine themselves to hedging their trading account securities as opposed to their total assets and liabilities. Additionally, it should be noted that the hedging activities for a bank is likely to be asymmetric. When a bank is hedging the securities in its trading account, it will only do so when it expects the interest rates to increase.

[19]Bernard (1984) reports that the relationship between unexpected inflation and stock returns cannot simply be explained by nominal contracting variables. He argues that unanticipated inflation affects firms through other channels. From an empirical standpoint the most important channel appears to be the systematic risk of firms. The parallel of Bernard's argument for this study is the potential impact that unexpected interest rates may have on the earnings of commercial banks via their effect on aggregate real activity. In this study, market returns are included as an explanatory variable in the specification of all the experiments conducted. Thus the differences amongst banks regarding their sensitivities to aggregate real economic activity are accounted for.

References

1. Alchian, Armen and Reuben Kessel "Redistribution of Wealth Through Inflation: Science. 130 (September 4, 1959), 535-39.

2. Bach, George L. and Albert Ando "The Redistributional Effects of Inflation," Review of Economics and Statistics. 39 (February 1957), 1-13.

3. Bach, George and James Stephenson "Inflation and the Redistribution of Wealth," Review of Economics and Statistics. 56 (February 1974), 1-13.

4. Bernard, Victor L. "Unanticipated Inflation, Real Assets and the Value of the Firm," Journal of Financial Economics. 15 (March 1986), 285-322.

5. Cornell, Bradford. "Do Money Supply Announcements Affect Short-Term Interest Rates?" Journal of Money Credit and Banking. 11 (February 1979), 80-86.

6. Cornell Bradford. "Money Supply Announcements and Interest Rates: Another Vice," Journal of Business. 56 (January 1983), 1-24.

7. Cornell, Bradford. "The Money Supply Announcements Puzzle: Review and Interpretation," American Economic Review. 73 (September 1983), 644-57.

8. Flannery Mark J. and Christopher M. James. "Effect of Interest Rate Charges On the Common Stock Returns of Financial Institutions," Journal of Finance. 39 (September 1984) 1141-53.

9. Flannery Mark J. and Christopher M. James. "Market Evidence on the Effective Maturity of Bank Assets and Liabilities," Journal of Money Credit and Banking. (November 1984), 435-45.

10. French, Kenneth R. "Stock Returns and the Weekend Effect," Journal of Financial Economics. 8 (March 1980), 55-69.

11. Grossman, Jacob "The Rationality of Money Supply Expectations and the Short-Run Response of Interest Rates of Monetary Surprises," Journal of Money Credit and Banking. 13 (November 1981), 409-24.

12. Hong, Hai. "Inflation and the Market Value of the Firm: Theory and Tests." Journal of Finance. 32 (September 1970), 1031-48.

13. Lynge, Morgan J. "Money Supply Announcements and Stock Prices ," Journal of Portfolio Management. 8 (Fall 1981).

14. Pearce, D. Douglas and Vance Roley. "The Reaction of Stock Prices to Unanticipated Changes in Money," Federal Reserve Bank of Kansas City, Research Working Paper 1982.

15. Roley, Vance. "Weekly Money Supply Announcements and the Volatility of Short-Term Interest Rates" Federal Reserve Bank of Kansas City, Economic Review, (February 1983), 3-15.

16. Urich, T. J. and P. Wachtel. "Market Responses to Weekly Money Supply Announcements in the 1970's," Journal of Finance, 36 (December 1981), 1063-72.

TABLE 1

Variables Used in Calculating the GAP Positions

Rate Sensitive Assets (RSA)

Federal Funds Sold
Fixed Rate Loans with Remaining Maturity Less Than One Year.
Investments With Remaining Maturity Less Than One Year.
Loans With Floating Interest Rate
Interest Bearing Overseas Placement (less than one year)
Trading Account Securities
Customers Acceptances
Interest Bearing Balances
Time and Savings Balances With Commercial Banks in U.S.

Rate Sensitive Liabilities (RSL)

Domestic Certificate of Deposits (less than one year maturity)
Foreign Certificate of Deposits (less than one year maturity)
Other Large Time Deposits
Federal Funds Purchased
Banks Liabilities on Acceptances (Domestic)
Banks Liabilities on Acceptances (Foreign)
Interest Bearing Demand Notes Issued on U.S. Treasury
Money Market Time Deposits

Dollar Value GAP=RSA-RSL

Percent GAP=(RSA-RSL)/Market Value of Equity

TABLE 2

DESCRIPTIVE STATISTICS ON INDIVIDUAL BANK GAPs

BANK NUMBER	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
1	0.0061	0.0046	-0.0009	0.0153	0.0012
2	0.0018	0.0022	-0.0022	0.0062	0.0005
3	-0.0061	0.0047	-0.0132	0.0034	0.0012
4	-0.0064	0.0046	-0.0132	0.0014	0.0012
5	0.0002	0.0039	-0.0039	0.0092	0.0010
6	-0.0003	0.0009	-0.0017	0.0011	0.0002
7	-0.0018	0.0018	-0.0046	0.0023	0.0004
8	0.0006	0.0032	-0.0041	0.0085	0.0000
9	0.0053	0.0106	-0.0075	0.0330	0.0027
10	-0.0000	0.0012	-0.0038	0.0016	0.0003
11	-0.0055	0.0025	-0.0037	0.0031	0.0006
12	-0.0007	0.0007	-0.0021	0.0004	0.0001
13	-0.0031	0.0015	-0.0061	0.0000	0.0003
14	-0.0020	0.0032	-0.0081	0.0035	0.0008
15	-0.0074	0.0035	-0.0115	-0.0026	0.0009
16	0.0003	0.0020	-0.0038	0.0036	0.0005
17	-0.0016	0.0052	-0.0133	0.0065	0.0013
18	0.0022	0.0010	0.0008	0.0044	0.0002
19	-0.0090	0.0047	-0.0211	-0.0019	0.0012
20	0.0005	0.0006	-0.0004	0.0017	0.0001
21	0.0023	0.0013	-0.0008	0.0041	0.0003
22	-0.0037	0.0022	-0.0062	0.0005	0.0005
23	-0.0440	0.0304	-0.0739	0.0101	0.0078
24	-0.0024	0.0014	-0.0053	-0.0007	0.0003
25	-0.0048	0.0023	-0.0105	-0.0008	0.0006
26	0.0002	0.0016	-0.0014	0.0036	0.0004
27	-0.0022	0.0027	-0.0054	0.0033	0.0007
28	-0.0031	0.0034	-0.0080	0.0037	0.0000
29	0.0011	0.0014	-0.0007	0.0041	0.0003
30	-0.0043	0.0054	-0.0105	0.0084	0.0014
31	0.0004	0.0011	-0.0011	0.0029	0.0003
32	-0.0062	0.0022	-0.0122	-0.0037	0.0005
33	-0.0098	0.0034	-0.0181	-0.0032	0.0008
34	-0.0031	0.0031	-0.0105	0.0021	0.0008
35	-0.0005	0.0009	-0.0019	0.0008	0.0002
36	-0.0062	0.0049	-0.0137	0.0023	0.0012
37	0.0014	0.0028	-0.0016	0.0077	0.0007
38	-0.0133	0.0074	-0.0248	-0.0008	0.0010
39	-0.0021	0.0021	-0.0052	0.0025	0.0005
40	-0.0001	0.0032	-0.0043	0.0056	0.0008
41	-0.0157	0.0137	-0.0347	0.0200	0.0035
42	-0.0000	0.0014	-0.0026	0.0019	0.0003
43	-0.0016	0.0006	-0.0027	-0.0004	0.0001
44	-0.0013	0.0006	-0.0020	0.0005	0.0001
45	-0.0054	0.0027	-0.0101	-0.0004	0.0007
46	-0.0001	0.0006	-0.0012	0.0010	0.0001

TABLE 3

Selected Statistics from the Portfolios

	Portfolio 1	Portfolio 2	Portfolio 3	SP500
Mean Return	0.00090	0.00074	0.00062	0.00055
Standard deviation of returns	0.00737	0.00744	0.00773	0.00923
Minimum Return	-0.03532	-0.04318	-0.0451	-0.0305
Maximum Return	0.07495	0.02859	0.04316	0.0465
Mean GAP	0.00248	-0.00133	-0.01024	
Standard Deviation of GAP	0.00135	0.00106	0.00331	
Minimum GAP	0.00029	-0.00659	-0.0144	
Maximum GAP	0.00505	0.00073	-0.00410	
Number of Banks	15	15	16	

TABLE 4

The Effects of Expected and Unexpected Money on Bank Returns[a]

$$RP_{it} = \alpha_{0i} + \alpha_{1i} (M_t^A - M_t^E) + \alpha_{2i} M_t^E + \alpha_{3i} RETSP500_t + U_{it}$$

	No. of Observation	α_{0i}	α_{1i}	α_{2i}	α_{3i}	R^2
Portfolio 1	171	0.00025	-0.00047	0.00027	0.39269	0.48
		(0.66)	(-2.69)	(1.04)	(11.13)	
Portfolio 2	171	0.00064	-0.00078	-0.00008	0.48992	0.57
		(1.62)	(-4.24)	(-0.28)	(13.20)	
Portfolio 3	171	0.00016	-0.00055	-0.00038	0.53998	0.55
		(0.38)	(-2.73)	(-1.30)	(13.27)	

Null Hypothesis	F-Statistic	Tail Area of the Test
$\hat{\alpha}_{11} = \hat{\alpha}_{12}$	1.488	0.22
$\hat{\alpha}_{11} = \hat{\alpha}_{12}$	0.093	0.76
$\hat{\alpha}_{11} = \hat{\alpha}_{12}$	0.698	0.40

[a]t-statistics in parenthesis.

TABLE 5

Seemingly Unrelated Regression Results of the Response of Bank Stock Returns to the Money Supply Announcements[a]

$$RP_{it} = \alpha_{0i} + \gamma_{0i} (M_t^A - M_t^E) + \gamma_{1i} (M_t^A - M_t^E) GAP_{it} + \gamma_{2i} M_t^E + \gamma_{3i} RETSP500_t$$

	α_{0i}	γ_{0i}	γ_{1i}	γ_{2i}	γ_{3i}	R^2
Portfolio 1	0.00025	-0.00045	-0.00671	0.00027	0.39285	0.48
	(0.66)	(-1.35)	(-0.05)	(1.04)	(11.06)	
Portfolio 2	0.00065	-0.00065	0.08094	-0.00008	0.49014	0.57
	(1.63)	(-1.79)	(0.42)	(-0.29)	(13.17)	
Portfolio 3	0.00016	-0.00055	0.00009	-0.00038	0.53990	
	(0.37)	(-0.73)	(0.00)	(-1.29)	(13.22)	0.55

The weighted R-square for the system = 0.38[b]

	The Average Response to Unexpected Money	F-statistic (Null Hyp:$\alpha 1i=0$)	Tail area of the test
Portfolio 1	$\bar{\alpha}11 = -0.00045 + (-0.00671)(0.00248) = -0.00045$	7.07	0.008
Portfolio 2	$\bar{\alpha}11 = -0.00065 + (0.08094)(-0.00133) = -0.00076$	15.37	0.0001
Portfolio 3	$\bar{\alpha}11 = -0.00055 + (0.00009)(-0.01024) = -0.00055$	6.71	0.009

Null Hypothesis	F-statistics	Tail area of the test
$\bar{\alpha}11 = \bar{\alpha}12$:	2.19	0.14
$\bar{\alpha}11 = \bar{\alpha}13$:	0.21	0.65
$\bar{\alpha}11 = \bar{\alpha}13$:	0.98	0.32

[a]t-statistics in parenthesis.
[b]This is the R-square that corresponds to the approximate F test on all non-intercept parmeters in the system.

TABLE 6

The Effects of Forecasted and Unexpected Interest Rates on Bank Stock Returns[a]

$$RP_{it} = \alpha_{0i} + \alpha_{1i} RES_t + \alpha_{2i} R_t + \alpha_{3i} RETSP500_t + U_{it}$$

	No. of Observation	α_{0i}	α_{1i}	α_{2i}	α_{3i}	R^2
Portfolio 1	876	0.00267	-0.00241	-0.00016	0.39887	0.29
		(2.59)	(-2.83)	(-1.89)	(16.54)	
Portfolio 2	876	0.003	-0.00232	-0.0002	0.45454	0.37
		(3.14)	(-2.93)	(-2.59)	(20.27)	
Portfolio 3	876	0.00223	-0.00176	-0.00016	0.50449	0.39
		(2.26)	(-2.15)	(-1.96)	(21.77)	

Null Hypothesis	F-statistics	Tail area of the test
$\hat{\alpha}11 = \hat{\alpha}12$:	0.007	0.92
$\hat{\alpha}11 = \hat{\alpha}13$:	0.303	0.58
$\hat{\alpha}11 = \hat{\alpha}13$:	0.238	0.63

[a]t-statistics in parenthesis.

TABLE 7

Seemingly Unrelated Regression Results of the Response of Bank Stock Returns to the Unexpected and Forecasted Interest Rates[a]

$$RP_{it} = \alpha_{0i} + \gamma_{0i} RES_t + \gamma_{1i} RES_t \; GAP_{it} + \gamma_{2i} R_t + \gamma_{3i} \; RETSP500_t + U_{it}$$

	α_{0i}	γ_{0i}	γ_{1i}	γ_{2i}	γ_{3i}	R^2
Portfolio 1	0.00267	-0.00141	-0.48689	-0.00016	0.39834	0.29
	(2.60)	(-0.86)	(-0.71)	(-1.90)	(16.51)	
Portfolio 2	0.00301	-0.00333	-0.58509	-0.00021	0.45375	0.38
	(3.15)	(-2.38)	(-0.88)	(-2.61)	(20.28)	
Portfolio 3	0.00228	-0.00475	-0.25679	-0.00016	0.50325	0.40
	(2.31)	-(1.49)	(-0.97)	(-1.99)	(21.72)	

The weighted R-square for the system = 0.21[b]

	The Average Response to Unexpected Money	F-statistic (Null Hyp:$\alpha 1i=0$)	Tail area of the test
Portfolio 1	$\bar{\alpha}11 = -0.00141 + (-0.48689)(0.00248) = -0.00262$	8.50	0.003
Portfolio 2	$\bar{\alpha}11 = -0.00333 + (-0.58509)(-0.00133) = -0.00255$	9.41	0.002
Portfolio 3	$\bar{\alpha}11 = -0.00475 + (-0.25679)(-0.01074) = -0.00212$	5.62	0.018

Null Hypothesis	F-statistics	Tail area of the test
$\bar{\alpha}11 = \bar{\alpha}12$:	0.004	0.947
$\bar{\alpha}11 = \bar{\alpha}13$:	0.301	0.002
$\bar{\alpha}11 = \bar{\alpha}13$:	0.287	0.592

[a]t-statistics in parenthesis.
[b]This is the R-square that corresponds to the approximate F test on all non-intercept parmeters in the system.