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Interest-Rate Exposure and Bank Mergers [1]

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Abstract: This study examines how interest rates and interest-rate exposures affect the level of acquisition activity, the identities of targets and acquirers, and the pricing of acquisitions in the banking industry. Using a sample of 477 large mergers from 1980 to 1994, we find that the level of acquisition activity is more negatively correlated with interest rates and more positively correlated with yield curve spreads for banks than for non-banks. Although we find that targets and acquirers have significantly different interest-rate exposures, we find little evidence that one group is consistently better or worse positioned, ex post, for various interest-rate environments. Finally, we find evidence that merger pricing is a function of the interest-rate environment, with acquirers paying higher prices and earning lower returns when rates are lower (and when more deals are announced.)

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I. Introduction

Bank executives and industry analysts would readily agree that interest-rate exposure is important to depository institutions. Research shows that interest rate movements affect bank earnings and value, and banks explicitly acknowledge this impact in their asset and liability management practices. [1] Interest rate changes can affect not only the value of individual assets and liabilities, but also the value of firm strategies, such as banks' investment programs. The purpose of this study is to examine how changes in interest rates affect one of the most significant investment decisions in the banking industry, the decision to acquire other banks.

Acquisitions have been a major phenomena in the consolidation of the U.S. banking industry over the last few decades and have been the defining strategy for some banks. For example, BancOne Corporation's explicit acquisition strategy resulted in 50 acquisitions in the decade ending in 1992, which increased the holding company's assets tenfold. Moreover, aggregate acquisition activity has been substantial. The total value of proposed bank mergers as a percentage of U.S. banks' book value of equity averaged 13% between 1981 and 1994,[2] and was three times larger than industry-wide investments

[1] For example, see Schrand (1996) for a discussion of how asset and liability management policies influence value-exposures of savings and loan associations or Esty, Tufano, and Headley (1994) for an analysis of asset and liability management at BancOne Corporation.

[2] The value of all proposed bank mergers came from Securities Data Company, and includes not only completed deals, but also withdrawn transactions. This value represents the value of cash and securities offered for the equity of the target, as banks typically acquire the equity of a bank in a takeover. The value of proposed transactions is compared with the book value of equity in the banking sector as of the end of the prior year, as reported by the Federal Reserve Bank Flow of Funds Accounts. This comparison is inexact for a number of reasons: it compares market values (with acquisition premiums offered) with book values prior to the acquisition run-up, and it may double acquisition activity if a withdrawn deal is subsequently completed by another bank. The calculation merely attempts to illustrate the order of magnitude of bank merger activity over the period.

in property, plant and equipment over the period.[3] Finally, banking mergers were an important segment of total U.S. merger activity, accounting for 7% of the total value from 1981 to 1994.[4]

Because changes in interest rates are an important determinant of bank values, cash flows, and profits, and because acquisitions represent a major investment activity for banks, it seems natural to ask how they are related. To study this relation, we constructed a database of large U.S. bank mergers (valued at over $50 million) that were announced from 1980 to 1994 when 10-year interest rates ranged from 5% to nearly 15%. We use both practitioner wisdom and academic theory to help frame hypotheses about how interest rates might affect the market for bank acquisitions, in particular the *level* of acquisition activity, the *identities* of targets and acquirers, and the *pricing* of deals.

Using a sample of 477 large banking mergers, we find that the level of bank acquisition activity is more negatively correlated with interest rates and more positively correlated with yield curve spreads for banks than for non-banks. Although we find that targets and acquirers have significantly different interest-rate exposures, we find little evidence that one group is consistently better or worse positioned, *ex post,* for various interest-rate environments. Finally, we find evidence that merger pricing and acquirer excess returns are a function of the interest-rate environment. This evidence suggests that interest rates and interest-rate exposure does, indeed, affect the market for bank acquisitions.

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[3] To calculate the additions to net property, plant and equipment, we obtained the aggregate value of bank premises, furniture and fixtures, and other assets representing bank premises from FDIC reports during this period. This information is contained in tables describing the assets and liabilities of commercial banks, published annually in the Federal Deposit Insurance Co., *Statistics on Banking* (Annual issues, 1980-1994).
[4] This calculation is based on data described later in this paper.

The paper is organized in six sections. Section II motivates the paper, applying Froot and Stein's (1991) model of imperfect capital markets to the banking sector to explain why interest-rate exposures could affect merger activity and pricing. Section III shows the relation between interest rates and the level of acquisition activity. Section IV describes the merger data used in the remainder of the study and defines how we measure interest-rate sensitivity. Section V provides empirical evidence on the interest-rate sensitivity of targets and acquirers, as well as the pricing of deals as a function of bank characteristics and the interest-rate environment. Finally, Section VI concludes.

II. Interest-Rate Exposures And The Market For Acquisitions

While bank acquisitions are primarily motivated by factors such as potential cost-savings and geographic expansion, interest-rate exposures could have some impact on the acquisition process. A number of authors have established a link between risk exposures and investment activities, both in theory and practice.[5] For example, Froot and Stein (hereafter F&S, 1991) examine the impact of exchange-rate movements on foreign direct investments. In their model, potential domestic and foreign buyers of a domestic asset are endowed with initial wealth in different currencies. Exchange-rate shocks affect the relative value of these endowments. Were there no capital market imperfections, changes in the potential bidders' initial endowments would be irrelevant, as each would be able to finance the purchase of the asset equally well. However, Froot and Stein suggest that

[5] Using empirical data, Fazarri, Hubbard and Petersen (1988) and Lamont (1996) document that fluctuations in cash flows can affect firm investment.

capital market imperfections, in particular costly external finance, prevent firms from bidding their unconstrained reservation prices for the asset. Instead, they are forced to make constrained bids which are a function of external financing costs. As a result, exchange rates affect the acquisition market because of their effect on relative wealth. Consistent with this hypothesis, Froot and Stein find that foreign direct investment patterns in the United States are related to exchange rate movements.

The application of this model to the banking acquisition market is direct.[6] Banks are "endowed" with certain assets and liabilities whose values are affected by interest rates. Like the firms in F&S's model, banks are free to adjust these exposures through hedging activities.[7] Some banks select interest-rate exposures different from their peers as a strategic choice, hoping to use this difference to their competitive advantage. As an empirical matter, banks do chose different exchange rate exposures. The Appendix to this paper describes the average interest-rate exposures of all publicly-traded banks. From 1980-94, on average, 53.4% of all banks were positioned to benefit from rate decreases (the range is from 36% to 69%), while 46.6% were positioned to benefit from rate increases. After the fact, some of these banks will appear to have been "lucky" while others will appear to have been "unlucky" and their respective earnings, cash flow and values will reflect these outcomes.

[6] Froot and Stein (1996) develop a version of a costly-external finance model for banking to prescribe risk management policies for banks.

[7] While interest-rate exposure can be easily changeable, it can nevertheless have large impacts on bank values. Banks can consciously choose certain exposures and leave them unchanged over time or they can hedge away interest rate risk. This aspect of interest-rate risk management makes exposures in part a policy decision of the bank with material value implications; for an example, see Esty, Tufano, and Headley (1994).

If there were no capital market imperfections, then changes in banks' relative endowments would not affect their acquisition decisions. However, Houston, James and Marcus (1996) show that bank loan decisions are a function of internal cash flow and that subsidiary bank loan growth is sensitive to holding company cash flow and capital position, suggesting that external capital is scarce and expensive for banks. In the extreme, regulatory constraints that prevent non-banks from acquiring banks make external financing infinitely costly for certain potential bidders.[8]

Consistent with a F&S-like model, we seek to motivate how interest rate shocks may affect the aggregate *level* of merger activity, the *identities* of bidders and targets, and the *pricing* of transactions. Consider three potential acquirers (banks A, B, and C). Following F&S, we assume that a bank's ability to acquire is a function of its internal wealth due to capital constraints. **Figure 1** shows each bank's ability to pay for targets as a function of interest rates. At current interest rates (r_0), all three have equal wealth and, therefore, equal ability to pay for a given target.[9] However, if rates were to rise to r_1, A's wealth or market value would rise (we would call it an asset-sensitive bank), B's would be unchanged, and C's would fall (we would call it liability-sensitive.) Initially, we assume that there is a fixed number of potential acquirers and only one potential target.

In the rising-rate environment, bank C might be effectively closed out of the acquisition market because its ability to pay drops relative to other banks. Alternatively,

[8] In this regard, the banking industry resembles the competitive environment described by Shliefer and Vishny (1992), in that buyers for assets are all drawn from existing competitors in the industry, who presumably are subject to common shocks. They show that if all firms in an industry experience a common shock (in this context, a change in interest rates), then liquidation values (in this context, acquisition prices) could drop due to the surplus of targets and dearth of acquirers from within the industry.

[9] Froot and Stein assume that the target is worth the same to all bidders, ignoring differences in valuation that are functions of different control.

were rates to drop, C would be better able to acquire targets than its rivals. Thus, the identity of acquirers is likely to be a function of their interest rate exposures and recent changes in rates.

Were the population of potential bidders to be unequally distributed among the three types of exposures, then the quantity of deals could also be a function of changes in the interest rate environment. For example, suppose that 1% of all potential acquirers shared C's exposure, 24% had B's exposure, and only 75% shared A's exposure. In rising rate environments, there would be many potential acquirers which might, in turn, increase the level of merger activity; alternatively, in falling rate environments, only a handful of potential acquirers could mount successful bids.[10] Practitioners have noted that low interest rates tend to accelerate bank merger activity, through their impact on bank stock prices.[11] We test this proposition by examining the relation between interest rates and the number and dollar value of bank mergers.

Instead of the quantity of deals changing in response to rates, the pricing of deals could also change. One might expect that the pricing of deals would become "rich" when many potential bidders are chasing a limited number of targets. Practitioners have suggested that interest-rate induced rises in stock prices could lead acquirers to pay higher prices for targets, suggesting a link between interest rates and acquisition prices. One analyst remarked, "Falling rates bolster the stock prices of many big banks. This, in turn, permits acquisition-minded banks to pay a higher premium for assets" (Breskin,

[10] Were there no capital constraints, these handful of bidders could buy an infinite number of banks. However, with costly external financing, they would be limited.

[11] For an example, see Arnold G. Danielson, "Banking in the Northeast States: What to Expect in Future Consolidation?" *Banking Policy Report* 14 (April 3, 1995); or Joseph Radigan, "Getting Out While the

1995). In this study, we examine deal pricing or quality by examining bidders' and targets' cumulative abnormal returns (CARs) at announcement, as well as other measures of acquisition premia.

Of course, changes in interest rates are likely to affect bank targets as well as acquirers. Interest-rate shocks that reduce the value of a target (and hence the amount of money a bidder would need to raise) make that firm easier to acquire in the F&S model, holding constant the distribution of acquirer ability-to-pay. Thus, the identity of targets might also be affected by the interest-rate environment and target exposures. This prediction is consistent with prior research has shown that acquisition targets are often relatively weak firms with poor recent performance. [12] We expect targets to be "unlucky" or poorly-positioned banks whose earnings and cash flows have been weakened due to interest-rate movements.

This discussion is intended to motivate why interest rates and their exposures might affect the level of acquisition activity, the identities of targets and acquirers and the pricing of deals. The precise implications of models like F&S are driven by the distribution of interest-rate exposures of potential acquirers and targets at any given point in time, and cannot be generally inferred. The purpose of the empirical analysis is not to test a particular model so much as to provide empirical evidence that sheds light on the link between interest rates and the workings of the acquisition market.

Getting's Good," *U.S. Banker* (March 1995): "But given the toll rising interest rates have taken, the year that is now nearly three months old may mark the passage of a remarkably busy period of consolidation."

[12] See Asquith (1983) for early evidence that targets experience a run-down in their stock returns prior to the announcement of the merger.

III. Interest Rates and the Level of Merger Activity

Publications that track merger and acquisition activity, such as *Mergerstat Review*, often rank the banking industry as the most active industry in terms of the number and value of mergers.[13] On average, bank mergers represent 7.3% of total mergers by number and 6.9% by value, rising in some years to be as much as 16% of the total value.[14] Annual levels of bank and non-bank merger activity are positively, but imperfectly, correlated with one another, with correlations of 63% and 16% for the value and number of deals, respectively. The *positive* correlations suggest that common factors affect both bank and non-bank merger activity. For example, aggregate merger activity tends to coincide with rising stock markets,[15] and practitioners have long suspected that bank mergers do as well.[16] The *imperfect* correlation between bank and non-bank mergers suggest that other factors may affect them differently. In particular, bank values and bank mergers may be more closely linked to interest rates, as interest rates may have a more direct and material impact on banks than non-banks.

To determine whether bank and non-bank mergers respond differently to stock market and interest-rate factors, we correlate annual measures of merger activity with

[13] For example, see *Mergerstat Review* from 1985 to 1995.

[14] Compiled from Securities Data Corp. merger and acquisition database, for the years 1981 to 1994. These figures represent the number and consideration value for completed merger transactions, including both full and partial acquisitions.

[15] For evidence spanning different time periods, see Melicher, Lodolter, and D'Antonio (1983), Nelson (1959), Warshawsky (1987), Shleifer and Vishny (1990), and Golbe and White (1988).

[16] "For the big banks, lofty stock prices translate into strong currency for acquisitions. That is one reason many analysts expect merger activity to increase in 1997." (Stephen E. Frank, "Time is Right to Take Stock of Little Banks," *Wall Street Journal,* November 18, 1996, p. C 1.)

stock market indices and interest rates over the period from 1981 to 1994. Specifically, we use two stock market indices (the S&P 500 Index and the S&P Money Center Bank Index) and two interest-rate measures (the yields on 1-year Treasury bills and 10-year Treasury bonds.) In addition, we correlate merger activity with the spread between one-year and ten-year Treasury yields. **Table 1** presents these correlations. Because we focus on large bank mergers later in the paper, defined as mergers where the total consideration offered is greater than $50 million, we show correlations for all bank mergers and for large bank mergers. This analysis shows that correlations for total bank and large bank merger activity are similar, particularly in terms of value.

Consistent with previous work, both bank and non-bank merger activity are positively correlated with broad equity indices. The correlation between bank merger volume and the S&P 500 is 63% compared to 35% for non-banks, although only the former is significantly different from zero at the 5% level. The correlations with the S&P Money Center Bank Index are both significant and approximately equal. We suspect that bank mergers may be slightly more closely linked with the equity indices because a large fraction of bank deals use stock as the form of consideration.

A more dramatic difference exists in the correlations with interest rates. **Table 1** shows that the value of bank merger activity is more negatively correlated with interest rates than non-bank merger activity (-80% vs. -28% for the l-year Treasury bill). As rates rise, the value of bank mergers declines more sharply than does non-bank mergers.[17]

[17] We suspect that the value of all bank deals is more strongly correlated with interest rates than the number of deals because bank stock prices and interest rates tended to be inversely related in the period we studied, as shown in the Appendix. As a result, rate increases would reduce not only the number of deals, but also the value per bank, leading to an even stronger relationship between rates and the value of bank deals than between rates and the number of deals.

One can also see a significant difference in the correlations with the yield curve spread. For non-banks, the correlation between the value of deals and the yield spread is *negative* 16% compared to *positive* 83% for banks. In other words, as the yield curve steepens, the value of bank mergers increases while the value of non-bank mergers declines.

These results confirm conventional wisdom that bank merger activity (the quantity of deals) is more closely related to interest rates and yield curve spreads than is non-bank merger activity. Of course, with a relatively short time-series, it is difficult to ascertain whether these correlations mistakenly capture the effects of other factors such as changes in regulation. Instead, this evidence provides some support for conventional wisdom and is suggestive of a relation between merger activity and interest-rates.

IV. Description of the Sample

A. Sample selection and description

Our merger data comes from the *Securities Data Company* (SDC) on-line M&A Database. Our sample includes all announced mergers and acquisitions from 1980-1994 in which the target firm was a U.S. bank or bank holding company[18], and the transaction was valued at $50 million or more.[19] We restricted ourselves to larger transactions because they represent 80-95% of all bank transactions in terms of value, exhibit similar interest-rate and equity market correlations to the full bank sample, and represent sizable

[18] We identify U.S. banks and bank holding companies by their SIC codes: 6000,6021, 6022, 6023, 6024, 6029, and 6712.

investments for acquiring banks (see **Table 1).** Furthermore, smaller banks are less likely to have publicly-traded stock which is needed to calculate interest-rate exposures. We define the announcement date as the first time the deal is publicly announced or is rumored by the press as being negotiated. We verified all announcement dates with the *Wall Street Journal Index* and *Lexis-Nexis.*

We deleted 98 transactions from our initial sample of 575 transactions for one of three reasons: the acquirers were not disclosed, the SDC data could not be verified using alternate sources, or there were non-bank targets, such as S&L's, involved. We then matched target and acquirer CUSIPs (or their ultimate parents' CUSIPs)[20] with the NYSE, AMEX. and NASDAQ files of the Center for Research on Securities Prices (CRSP), leaving a sample of 477 deals with CRSP matches for either the target *or* the acquirer. There are 423 acquirers and 339 targets included in these 477 transactions, and 296 transactions where we could get CRSP data on *both* the target *and* acquirer. **Table 2** presents the distribution, by year, of the number and value of transactions in our sample. The lower panel shows the distribution of acquisitions along two dimensions: full mergers vs. partial acquisitions (typically branch acquisitions or sales of subsidiaries such as leasing companies or credit card portfolios), and ultimately completed vs. withdrawn transactions. The majority of our deals are completed mergers.

In addition, we collected balance sheet and income statement data for target banks including asset size, net income, non-interest (or operating) expense, shareholders'

[19] The value of a transaction includes the total value of consideration paid by the acquirer (for common stock or equivalents, preferred stock, debt options, assets, warrants and stake purchases), excluding fees and expenses. Liabilities assumed are included in the value if they are publicly disclosed.

[20] When targets' and acquirers' CRSP stock data are not available, we use their ultimate parents' CRSP stock data.

equity, and non-performing assets. SNL Securities provided some of this information; we collected the rest by hand from annual reports and 10-K statements. **Table 3** provides a summary of this information for targets. Targets are significantly smaller and less profitable than acquirers. In addition, they have significantly less equity capital and proportionally more non-performing loans. They also tend to have significantly different interest-rate exposures, which we discuss in more detail below.

B. Methodology for measuring interest-rate sensitivity

We estimated interest-rate sensitivities using a two-factor model which prior research has shown to be a parsimonious specification for capturing interest-rate exposure.[21] In particular, we estimated the following two-factor regression using OLS:

$$R_{it} = \beta_{i0} + \beta_{iM} R_{Mt} + \beta_{iI} R_{It} + \varepsilon_{it}$$

where R_{it} *is* the daily holding period return for bank *i* stock between t-1 and t, R_{Mt} is the daily holding period return on a value-weighted portfolio of common stocks (the value weighted market index from the combined NYSE, AMEX and NASDAQ CRSP file) between t-1 and t, and R_{It}, is the daily holding period return on 10-year constant maturity Treasury bonds between t-1 and t. Like Flannery and James (1984), we proxy holding period returns for our interest-rate index with the yield relative, defined as $-(Y_t - Y_{t-1}) / Y_{t-1}$, where Y_t is the yield to maturity. For long bonds, the yield relative is approximately equal to the holding period return.

[21] See Stone (1974), Lynge and Zumwalt (1980), Flannery and James (1984), Scott and Peterson (1986), Unal and Kane (1988), Akella and Chen (1990), Choi, Elyasiani, and Kopecky (1992), Sweeney and Warga (1986), and Schrand (1996).

Our procedure for estimating interest-rate sensitivity is consistent with previous literature. For example, because we use daily returns, we correct for non-synchronous trading (see Scholes and Williams, 1977) by using the algorithms developed by Dimson (1977) and Fowler and Rorke (1983). We do not correct or "whiten" our interest-rate series for autocorrelation because Flannery and James (1984, footnote 10) and Unal and Kane (1988, Section IIB) show that such corrections do not materially alter the estimates of interest betas. And finally, we do not orthogonalize our series of interest and market returns to "eliminate" potential multicollinearity because Gilberto (1985) shows that orthogonalization can bias estimation. Moreover, both Unal and Kane (1988) and Carter and Sinkey (1996) find that orthogonalization does not affect the results.

The coefficient β_{iI} represents bank i's interest-rate sensitivity or beta. A positive interest-rate beta (β_{iI}) indicates that a bank's stock returns are *positively* correlated with changes in the price (returns) of 10-year Treasury bonds and *negatively* correlated with changes in the 10-year Treasury yield. Banks with positive interest-rate betas benefit (have positive stock returns) when bond prices rise or as interest rates fall, and are classified as "liability-sensitive." Conversely, banks that benefit from falling bond prices (or rising interest-rates) are said to be "asset-sensitive."

Appendix 1 shows that the interest-rate sensitivity of the banking sector was neither constant over the 15 year period we study—Kane and Unal (1988) present similar findings for the period from 1975-85—nor uniform across the banks. To control for industry related changes in exposure over time, we define a bank's *industry-adjusted* interest-rate sensitivity by measuring its deviation from the average bank's sensitivity in

the year of the merger announcement. A positive industry-adjusted interest-rate beta implies that a bank is more liability sensitive than the average bank, and that its stock returns would have been relatively greater for a given decline in interest rates.[22]

To check the robustness of our results, we construct three additional specifications for interest-rate exposure. First, using daily 10-year returns, we calculate a bank's *size-adjusted* interest-rate beta, in order to control for differences in positioning that are the attributable to firm size.[23] To adjust for size, we divide the full sample of publicly-traded banks (described in the Appendix) into quartiles based on the market value of equity. For each quartile, we calculate the average interest-rate beta and measure deviations from that mean beta according to the bank's size. A positive size-adjusted interest-rate beta implies that a bank is more liability sensitive than the average bank in its size quartile. Second, we calculate interest betas using 1-year instead of 10-year Treasury bond returns. Finally, we calculate interest betas using weekly instead of daily returns to minimize the non-synchronous trading problem. In the interest of space, we report only the results using daily data and the 10-year returns, but comment on differences attributable to using these other ways of measuring exposures.

[22] We used CRSP, Compustat, and SNL Securities to compile a list of traded banks to calculate the industry average interest rate sensitivity--see the Appendix.

[23] The relation between bank size and interest-rate sensitivity is not strong. In fact, the correlation between bank size (measured as the market value of equity) and interest beta is 11%, on average over our sample period, and is not significant in most years **(see the Appendix).**

V. Empirical Results

A. The interest-rate sensitivity of targets and acquirers

Many factors such as prior firm performance, growth, leverage, board structure, and CEO characteristics affect whether a firm is a takeover target or acquirer.[24] In this section, we seek to understand whether bank targets and acquirers also differ with respect to their interest-rate sensitivity. We speculate that targets may be "unlucky" banks that have been weakened, whereas acquirers may be "lucky" banks that have been strengthened by the impact of their positioning in a particular interest-rate environment.

Although **Table 3** shows the major result of this section—that acquirers and targets have very different interest-rate sensitivities — **Table 4** examines this difference in more detail. **Table 4** reports industry-adjusted interest-rate betas for targets and acquirers, as well as for subsamples of full mergers vs. partial acquisitions and ultimately completed vs. withdrawn transactions. The bottom panel of the table reports the interest-rate betas for targets and acquirers in different interest-rate environments. In general, the order of magnitude of these exposures is roughly in line with those found by Schrand (1996), who studies savings and loan associations.[25]

Acquirers and targets differ in terms of interest-rate exposures. The mean industry-adjusted interest-rate beta for acquirers is +.059 compared to -.013 for targets, a difference that is statistically significant at the 1% level. Whereas acquirers are more liability-sensitive, positioned to benefit from falling interest rates, targets are more asset-

[24] An early contribution to this literature is Palepu's (1986) work on predicting takeover targets.
[25] Schrand (1996) estimated interest-rate sensitivity for 57 thrifts using a two-factor model and monthly returns on 20-year bonds. For her sample, the mean interest rate beta is -0.04.

sensitive, or positioned to benefit rising interest rates. In the top panel, we see that the difference between acquirers and targets persists across various subsamples: full vs. partial acquisitions as well as completed vs. withdrawn transactions. Because interest rates were falling through much of the sample period, acquirers were better positioned to benefit from falling rates than targets in a global sense. The results using unadjusted, size-adjusted, 1-year, or weekly interest-rate betas are quite similar.

In the bottom panel, we examine the interest-rate sensitivity of full mergers only as a function of the interest rate environment in place in the year prior to the acquisition announcement. We divide the sample into three equal sub-samples based on the level of the 10-year Treasury yield: high, medium, and low.[26] Similarly, we divide the sample by the direction of change in 10-year rates: rising, stable, or falling.[27] The differences *between* targets and acquirers are most pronounced in low and medium rate environments and in stable and rising rate environments. However, one can see little difference *within* the groups of targets and acquirers as a function of the level or change in rates.

Based on practitioner wisdom, we expected to see that targets would be less well positioned than acquirers, *ex post*, for realized rate movements. For example, targets would have been positioned for falling rates in rising-rate environments (have a positive interest-rate beta), while acquirers would have been positioned for rising rates (have a negative interest-rate beta). We fail to observe this pattern. In fact, in periods where

[26] 10-year Treasury bond yields are less than 7.2% in the low environment; between 7.2% and 8.7% in the medium environment and more than 8.7% in the high environment.

[27] A merger occurs in a falling rate environment if the 10-year rate in the announcement month is more than 50 basis points below the trailing twelve month average; a stable environment is when the current rate is within 50 basis points of the average; and a rising environment is when the current yield is greater than 50 basis points above the average.

rates were rising *ex post,* targets were somewhat luckier than acquirers in that they were less liability-sensitive, i.e. they were better positioned to benefit from a rising rates.[28] Where differences in rate-positioning between targets and acquirers are most pronounced (measured by significant differences), targets seem to have been *better* positioned *ex post* than acquirers for the realized rate moves. Thus, we find no evidence that acquirers are consistently better positioned or luckier than targets with respect to interest-rate exposures.

Table 5 uses multiple regression analysis to analyze the relation between target and acquirer unadjusted interest-rate betas and the level of 10-year yields, the change in yields, the steepness of the yield curve, and bank size, as defined below:

Level	= current level of 10-year Treasury Bond yields
Trend	= current 10-year yield minus trailing 12-month average yield
Steepness	= difference between 10-year and 1-year Treasury yields
Size	= logarithm of total assets

In addition, we create a dummy variable for acquirers to test if the average exposure of targets and acquirers differ, and three interaction terms—one for each of the interest-rate environment variables (Level, Trend, and Steepness)—to test whether their positioning responds differently to the interest-rate environment.

We find that the level of bank positioning, as well as the relationship between positioning and market conditions, varies between targets and acquirers. The acquirer fixed effect is positive and significant at the 5% level which means acquirers are more liability-sensitive on average than targets, consistent with the univariate results in **Table**

[28] Were there mean-reversion in rates, these positions might be justified, in that the acquirers would be set up for reversal of rates. However, the acquirer's more extreme liability-sensitivity would have been unlucky, ex post, in the previously realized rising-rate environment.

4. Target and acquirer positioning is related to the interest rate environment, particularly the level and trend in interest rates. Targets' interest-rate betas were higher (they were more liability-sensitive or positioned for falling rates) when 10-year yields were high and when they had fallen in the year prior to the merger announcement. However, acquirers' exposures were quite differently related to rates. Acquirers' betas were *lower* in precisely those times when targets tended to be high; acquirers were less liability-sensitive in high-rate environments (the significant negative coefficient on the Acquirer/Level interaction variable) and more liability-sensitive in rising-rate environments (the significant positive coefficient on the Acquirer/Trend interaction variable). As before, we see that targets seem to have been "better" positioned or luckier, *ex post*, over the year prior to the acquisition. This finding runs contrary to our hypothesis that targets would have been weakened by mispositioning. Finally, bank positioning is not a function of bank size as reported earlier and in the **Appendix.**

In conclusion, targets and acquirers differ with respect to interest-rate positioning just as they differ with respect to size, profitability, capitalization, asset quality, and efficiency (see **Table 3).** We were concerned that the difference in positioning merely reflected differences in the financial characteristics listed above, but apparently it does not. As reported in **Table 5,** bank size cannot explain the difference in positioning. (When we repeated the analysis in Table 5 using size-adjusted betas, we continued to find significant differences between targets and acquirers.) As a further test, we ran correlations between the industry-adjusted betas and other target financial characteristics. The correlations were not significant, with the correlation of betas being -0.058 for profitability (return on average assets), -0.028 for efficiency (operating expense as a

percentage of average assets), -0.027 for capitalization (equity as a percentage of assets), and -0.088 for asset quality (non-performing assets as a percentage of total assets). That none of these correlations is significant suggests that the interest-rate exposure variable is not simply capturing more fundamental differences between the two subgroups. Thus we conclude that these differences are not easily explained nor are they consistent with a simple story of targets being unlucky and acquirers being lucky with respect to interest-rate bets.

B. The "pricing" of bank acquisitions

In some interest-rate environments, there might be excess demand or supply of targets. Put in practitioner terms, there might be opportunities to "bottom fish" in some interest-rate environments while, in other environments, pricing might become "rich". In our rendering of Froot and Stein's (1991) model, pricing differences could result from demand or supply imbalances stemming from heterogeneity in bank positioning. We test this proposition by examining deal pricing as a function of the interest-rate environment and of the interest-rate positioning of targets and acquirers, where pricing is measured as abnormal announcement returns for targets and acquirers. For a subsample of banks, we also examine pricing in terms of target multiples.

We used standard event-study methodology to compute abnormal returns over a three-day window around the merger announcement.[29] For each bank, we estimated the following equation:

[29] See Brown and Warner (1980, 1985). Their 1985 paper shows that calculation of multi-day abnormal returns is not materially changed by Dimson (1977) or Scholes-Williams (1977) corrections.

$$R_{it} = \beta_{i0} + \beta_{iM} R_{Mt} + \varepsilon_{it}$$

where R_{it} is the daily holding period return for bank i stock between $t-1$ and t, R_{Mt} is the daily holding period return on a value-weighted portfolio of common stocks (the value weighted market index from the combined NYSE, AMEX and NASDAQ CRSP file) between $t-1$ and t. Our estimation period is from 270 to 21 days prior to the announcement of the merger; our event window is the day before, the day of, and the day after the announcement. While we report abnormal returns from a *one-factor* model so that readers can compare our results to other papers on bank mergers, we also calculated abnormal returns using a *two-factor* model. The results using the two-factor model do not differ materially from the one-factor results we report.

Table 6 reports the CARs for the sample of targets and acquirers, as well as for the subsamples used in **Table 4.** Our results replicate prior merger studies: the average target has a large, positive abnormal return of 12.7% while the average acquirer has a small, negative abnormal return of -1.0%; these returns are significantly different from each other and significantly different from zero.[30] The top panel in **Table 6** shows that there are material differences between full mergers and partial acquisitions (t-statistics = 4.45 for acquirers and 2.65 for targets), but not between completed and withdrawn deals. For this reason, we focus on full mergers for the remainder of the paper. In addition, we

[30] Cornett and De (1991) find target banks in interstate mergers experience two-day abnormal returns of 8.10%; Cornett and Tehranian (1992) find target banks experience two day excess returns of 4.7% in interstate mergers and 11.0% in intrastate mergers. There is less uniformity in results for the bidders: Cornett and De find a positive excess return of 0.55%; Cornett and Tehranian find a negative return of 0.80% although it is lower for intrastate mergers; and James and Weir (1987a) find a positive excess return of 1.07%. The difference between our finding and these other findings may be due to differences in time periods or the fact we have a much larger sample and include smaller acquisitions.

exclude four failed bank acquisitions, as James and Wier (1987b) show that these acquisitions are significantly different from healthy bank acquisitions.

The bottom panel of **Table 6** shows the relative magnitudes of CARs across different interest-rate environments for full mergers. Although we find consistent differences between targets and acquirers, we do not find significant differences in the pricing of deals across different interest-rate environments (high vs. low or rising vs. falling). However, these univariate results may be misleading because they ignore bank-specific and transaction-specific factors which have been shown to affect acquisition pricing.[31] Therefore, we run cross-sectional regressions with pricing measures (excess returns) as the dependent variables, and bank- and transaction-specific factors as the independent variables. In particular, based on prior studies of bank merger pricing, we include the following control variables in the analysis (see Palia (1994) for a survey of 17 studies):

Transaction characteristics:

- Consideration: a dummy variable which equals one if the primary consideration offered was cash (see Asquith, Bruner, and Mullins (1983), or Cornett and De (1991));
- Intrastate: a dummy variable which proxies for potential cost savings. The variable equals one if the target and acquirer are located in the same state (see Cornett and Tehranian (1992) on interstate mergers);
- Post 1985 deals: a dummy variable which equals one if the deal was announced after the Supreme Court's 1995 decision in the Northeast Bancorp case which legitimized interstate mergers (see Palia (1994) and Baradwaj, Dubofsky, and Fraser (1991));
- Acquisition program: a dummy variable which equals one if the acquirer has announced at least one merger in the prior twelve months (see Schipper and Thompson, 1983),

[31] See, among others, Palia (1993, 1994), Baradwaj, Dufofsky and Fraser (1991), Cornett and De (1991), and Beatty, Santomero and Smirlock (1987).

- Pooling accounting: a dummy variable which equals one if the deal was done using pooling accounting.

Target firm characteristics:

- Size: the inverse of total assets (in millions);
- Efficiency: the industry-adjusted ratio of non-interest expense to average assets;
- Capital: the industry-adjusted ratio of equity to total assets;
- Capital*Post 1985: an interaction variable to mark transactions occurring after the creation of uniform capital requirements for all banks in 1985;[32]
- Profitability: the industry-adjusted return on average assets;
- Asset quality: the industry-adjusted ratio of non-performing loans to total assets.

We obtained these data from the *Securities Data Company's* M&A database, SNL Securities, and from annual reports. To make the industry adjustments for the target firm characteristics, we collected industry data for large banks (those banks with assets from $100 million to $100 billion) from the FDIC Statistics on Banking (1995) and Berger, Kashyap, and Scalise (1994).

Because we are interested in how both the interest-rate environment and bank positioning affects merger pricing, we also include information on interest rates and bank exposures. The interest-rate environment variables are the level of the 10-year Treasury yields at the time of the announcement, the trend in yields (the difference between the current 10-year Treasury yield and the trailing twelve month average yield), and the steepness of the yield curve (the difference between the 10-year and 1-year Treasury yields). The results in **Table 7** can be thought of as a base-level set of results, helping to

[32] We also included an interaction variable for the capital ratio post-1992, a date after which banks had to comply fully with the Basel Accord and were subject to the Federal Deposit Insurance Corporation Improvement Act of 1992 (FDICIA). The impact of capitalization was not significantly different in the post- 1992 period from the 1985-92 period and so we did not include the variable.

answer whether the interest rate environment affects pricing after controlling for bank specific factors.

In addition to examining target and acquirer CARs, we also look at three other pricing measures used by practitioners—purchase price to target book value, purchase price per share divided by trailing target earnings per share, and the price paid relative to the target's core deposits.[33] Because SNL securities had this information for only certain transactions after 1986, our sample size drops to as few as 113 banks in some regressions. Nevertheless, because the correlations among these pricing measures and the target and acquirer CARs are quite small, we believe they capture different aspects of deal pricing and are important to analyze.[34]

After controlling for deal and bank characteristics, we find that the interest-rate environment is systematically and consistently related to acquirer performance and some measures of pricing. When interest rates are high, acquirers earn higher abnormal returns. One explanation why they earn higher abnormal returns is because they are paying lower prices: all three pricing multiples have negative coefficients, and two of these variables (Price/Book and Premium to core deposits) are statistically significant. In conjunction with our finding of a negative relationship between the quantity of deals and interest rates in **Table 1,** it appears that there are fewer announced deals when rates are high, and they are done at lower prices. Alternatively, when rates are low, the market appears overheated, with more deals being consummated at relatively higher prices. This

[33] The premium to core deposits is defined as the deal value less tangible book value of equity, divided by core deposits where core deposits equal total deposits less foreign deposits and deposits over $100,000.

[34] The correlation between target CARs and price/book, price/earnings, and premium/core deposits are 8.6%, - 16.8%, and 9.8%, respectively. The correlation between acquirer CARs and the same premia are -13.0%, -13.3%, and -9.2%.

finding is consistent with practitioner wisdom that lower rates induce acquirers to pay more (and do worse.) Not only are the pricing differences statistically significant, they are also economically significant: a 1% increase in the level of rates results in 5% reduction in the price/book multiple and a 5% increase in the acquirer's CAR.

We also find that acquirers do worse (and prices are higher) when rates have recently risen—the coefficient on the trend variable (-0.0064) is negative and significant. Again, two of the three pricing multiples are positive and significant indicating acquirers pay more in rising rate environments. Finally, there is some evidence that suggests acquirers pay less when the yield curve steepens: all three pricing multiples have negative coefficients, but the positive coefficient on the yield curve variable is not significant. Taken together, this evidence suggests that interest rates affect the pricing of deals systematically.

However, somewhat tempering our enthusiasm for this story, we observe no relationship between rates and target CARs, which is inconsistent with the argument. We do not have a good explanation for why the interest-rate environment would affect acquirers' abnormal returns and deal pricing, but not target CARs. Our initial hypothesis was that we were omitting an important variable—bank positioning. But when we include the targets' and acquirers' positioning, in particular whether they were, *ex post*, lucky or unlucky with respect to changes in rates, we do not find consistent results (in the interest of space, we do not report these results in the tables). Targets' abnormal returns are not related to either their own positioning or their acquirer's positioning. However, acquirers' abnormal returns are somewhat related to target positioning: acquirers who buy poorly-positioned or unlucky targets have significantly lower abnormal returns. Yet

when we change the positioning variable from a dummy variable (a dummy variable for lucky/unlucky with respect to rate changes) to a continuous variable (lucky/unlucky times the target's industry-adjusted interest-rate beta), this result losses statistical significance. Thus, we are left with little confidence that target or acquirer positioning affects the pricing of transactions.

The finding that the interest-rate environment, but not bank positioning, affects acquisition pricing probably reflects the fact that acquisition pricing is set by market-wide forces which, in turn, determine the balance between the demand for acquisitions and the supply of targets. In the aggregate, bank positioning seems less important to pricing than other bank and deal factors such as the form of consideration, potential for intrastate economies, and capitalization, and the market-wide effects interest rates have on the relative supply and demand for banks. In particular, the notion that lower interest-rates bring more potential buyers into the market, leading to an increase in acquisition activity and in higher prices, seems plausible.

VI. Conclusions

In this paper, we examine the relation among interest-rates, interest-rate exposures and an important class of investment decisions—bank acquisitions. Our analysis reveals three results. First, as rates fall, bank mergers increase. Bank merger activity is more negatively correlated with interest-rates and more positively correlated with yield spreads than non-bank merger activity. This finding suggests that interest-rate exposure has an impact on the level of bank merger activity, as it does on the market for bank shares.

Second, we find that acquirers have been liability-sensitive than targets. Because rates have generally fallen over the past fifteen years, it appears that the acquirers have been better positioned, *ex post*, for this overall drop in rates. However, targets appear to have been better positioned than acquirers with respect to short-run changes in rates. Thus there is mixed evidence supporting the initial hypothesis that well-positioned or lucky banks might be acquirers while poorly-positioned or unlucky banks might be targets.

Finally, we find that acquirers pay lower premia in high-rate environments and, as a result, have higher abnormal returns at announcement. Thus, deal pricing seems related to the rate-environment. This finding, along with the documented negative relation between interest rates and the quantity of deals, is consistent with a theory of hot acquisition markets—similar to hot IPO markets (see Ritter, 1984). Practitioners often assert that the number of deals and the pricing of deals increase in low-rate environments; our empirical analysis supports this view.

References

Akella, S.R. and S-J. Chen (1990), "Interest-Rate Sensitivity of Bank Stock Returns: Specification Effects and Structural Changes," Journal of Financial Research 13, Summer, pp. 147-154.

Asquith, P. (1983), "Merger Bids, Uncertainty, and Stockholder Returns," Journal of Financial Economics 11, pp. 51-83.

Baradwaj, B. G., D.A. Dufofsky and D.R. Fraser (1991), "Bidder Returns in Interstate and Intrastate Bank Acquisitions," Journal of Financial Services Research 5, pp. 261-273.

Beatty, R. P., A.M. Santomero and M.L. Smirlock (1987), "Bank Merger Premiums: Analysis and Evidence," Monograph 1987-3, Salomon Brothers Center for the Study of Financial Institutions, Graduate School of Business Administration, New York University.

Berger, A. N., A. K. Kashyap, J. M. Scalise (1995), "The Transformation of the U.S. Banking Industry: What a Long, Strange Trip It's Been," Brookings Papers on Economic Activity 2, pp. 55-218.

Breskin, Ira (1995), "Bank's Best Investment: Their Own Stock," Investor's Business Daily, August 11, p. Al.

Brown, S.J. and J.B. Warner (1980), "Measuring Security Price Information," Journal of Financial Economics 8, pp. 205-258.

Brown, S.J. and J.B. Warner (1985), "Using Daily Stock Returns: The Case of Event Studies," Journal of Financial Economics 14, pp. 3-31.

Carter, David A. and Joseph F. Sinkey, Jr. (1996), "The Effects of Interest-Rate Derivatives on the Common Stock Returns of U.S. Commercial Banks," University of Georgia working paper.

Cheng, D. C., B.E. Gup, L.D. Wall (1989), "Financial Determinants of Bank Takeovers," Journal of Money, Credit, and Banking, 21, pp. 524-536.

Choi, J. J., E. Elyasiani and K.J. Kopecky (1992), "The Sensitivity of Bank Stock Returns to Market, Interest and Exchange Rate Risks," Journal of Banking and Finance 16, pp. 983-1004.

Cornett, M. M., and Sankar De (1991), "Medium of Payment in Corporate Acquisitions: Evidence from Interstate Bank Mergers," Journal of Money, Credit, and Banking 23, pp. 767-776).

Cornett, M. M., and Sankar De (1991), "Common Stock Returns in Corporate Takeover Bids: Evidence from Interstate Bank Mergers," Journal of Banking and Finance 15, pp. 273-295.

Cornett, M.M. and H. Tehranian (1992), "Changes in Corporate Performance Associated With Bank Acquisitions," Journal of Financial Economics 31, pp. 211-234.

Danielson, Arnold G. (1995), "Banking in the Northeast States: What to Expect in Future Consolidation?" Banking Policy Report 14, April 3.

Dimson, E. (1979), "Risk Measurement When Shares are Subject to Infrequent Trading," Journal of Financial Economics 7, pp. 197-226.

Esty, B., P. Tufano, and J. Headley (1994), "Banc One Corporation: Asset and Liability Management," Journal of Applied Corporate Finance 7, pp. 33-51.

Fazzari, S.M., R.G. Hubbard, and B.C. Peterson (1988), "Financing Constraints and Corporate Investment," Brookings Papers on Economic Activity 1, pp. 141-195.

Federal Deposit Insurance Corporation (1995), Statistics on Banking--Historical 1934-1994 (Volume 1).

Flannery, M.J. and C.M. James (1984), "The Effect of Interest-rate Changes on the Common Stock Returns of Financial Institutions," Journal of Finance 39, pp. 1141-1153.

Fowler, D. J., C.H. Rorke (1983), "Risk Measurement When Shares are Subject to Infrequent Trading," Journal of Financial Economics 12, pp. 279-283.

Frank, Stephen F. (1996), "Time is Right to Take Stock of Little Banks," Wall Street Journal, November 18, p. Cl.

Froot, Kenneth A., David S. Scharfstein, and Jeremy C. Stein (1993), "Risk Management: Coordinating Corporate Investment and Financing Policies," Journal of Finance 48, pp. 1629-1658.

Froot, Kenneth A. and Jeremy C. Stein (1991), "Exchange Rates and Foreign Direct Investment: An Imperfect Capital Markets Approach," Quarterly Journal of Economics 106, pp. 1191-1218.

Froot, Kenneth A. and Jeremy C. Stein (1996), Risk Management, Capital Budgeting and Capital Structure Policy for Financial Institutions: An Integrated Approach." NBER Working Paper 5403.

Giliberto, M. (1985), "Interest-rate Sensitivity in the Common Stocks of Financial Intermediaries: A Methodological Note," Journal of Financial and Quantitative Analysis 20, pp. 123-126.

Golbe, D.L. and L.J. White (1988), "A Time Series Analysis of Mergers and Acquisitions in the U.S. Economy," Chapter 9 in A.J. Auerbach, cd., Corporate Takeovers: Causes and Consequences. University of Chicago Press, Chicago, IL.

Houston, Joel, Christopher James, and David Marcus (1996), "Capital Market Frictions and the Role of Internal Capital Markets," unpublished working paper, Graduate School of Business, University of Florida.

James, C. and P. Wier (1987a), "Returns to Acquirers and Competition in the Acquisition Market: The Case of Banking," Journal of Political Economy 95, pp. 355-370.

James, C. and P. Wier (1987b), "An Analysis of FDIC Failed Bank Auctions," Journal of Monetary Economics 95, pp. 141-153.

Lamont, O. (1996), "Cash Flow and Investment: Evidence From Internal Capital Markets," National Bureau of Economic Research, Working Paper 5499, March.

Kane, Edward J. and Haluk Unal (1988), "Change in market Assessments of Deposit Insurance Riskiness," Journal of Financial Services Research 1, pp. 207-229.

Lynge, M.J. and J.K. Zumwalt (1980), "An Empirical Study of the Interest-rate Sensitivity of Commercial Bank Returns: A Multi-Index Approach," Journal of Financial and Quantitative Analysis 15, pp. 731-42.

Melicher, R.W., J. Ledolter, and L.J. D'Antonio (1983), "A Time-Series Analysis Of Aggregate Merger Activity," Review of Economics and Statistics 65, 423-430.

Mergerstat Review, W.T. Grimm, various issues.

Nelson, R.L. (1959), Merger Movements In American Industry 1895-1956, Princeton University Press.

Palepu, Krishna G. (1986), "Predicting Takeover Targets: A Methodological And Empirical Analysis," Journal of Accounting and Economics 8, pp. 3-35.

Palia, D. (1993), "The Managerial, Regulatory, and Financial Determinants of Bank Merger Premiums," The Journal of Industrial Economics, 41, pp. 91-102.

Palia, D. (1994), "Recent Evidence on Bank Mergers," Financial Markets, Institutions & Instruments 3, pp. 36-59.

Radigan, Joseph (1995), "Getting Out While the Getting's Good," U.S. Banker, March.

Ritter, Jay R., (1984), "The "Hot Issue" Market of 1980," Journal of Business 57, pp. 215-240.

Schipper, Katherine and Rex Thompson (1983), "Evidence on the Capitalized Value of Merger Activity for Acquiring Firms," Journal of Financial Economics 11, pp. 85-119.

Scholes, M, and J. Williams (1977), "Estimating Betas from Nonsynchronous Data," Journal of Financial Economics 5, pp. 309-327.

Schrand, C.M. (1996), "The Association Between Stock-Price Interest Rate Sensitivity and Disclosures about Derivative Instruments," University of Pennsylvania, August.

Scott, W.L. and R.L. Peterson (1986), "Interest-rate Risk and Equity Values of Hedged and Unhedged Financial Intermediaries," Journal of Financial 9, pp. 325-329.

Shleifer, Andrei, and Robert Vishney (1992), "Liquidation Values and Debt Capacity: A Market Equilibrium Approach," Journal of Finance 47, pp. 1343-1366.

Shleifer A., and R.W. Vishny (1990), "The Takeover Wave Of The 1980s," *Science* 249, pp. 745-749.

Stone, B.K. (1974), "Systematic Interest-rate Risk in a Two Index Model of Returns," Journal of Financial and Quantitative Analysis 9, pp. 709-721.

Sweeney, R.J. and A.D. Warga (1986), "The Pricing of Interest-rate Risk: Evidence from the Stock Market," Journal of Finance 41, pp. 393-410.

Unal, H. and E.J. Kane (1988), "Two Approaches to Assessing the Interest-rate Sensitivity of Deposit Institution Equity Returns," Research in Finance 7, pp. 113-137.

Warshawsky, M. (1987), Determinants of Corporate Merger Activity: A Review Of The Literature, Federal Reserve Staff Study #152, April.

White, H. (1980), A Heteroskedasticity-consistent Covariances Matrix Estimator and a Direct Test for Heteroskedasticity, Econometrica 48, pp. 817-838.

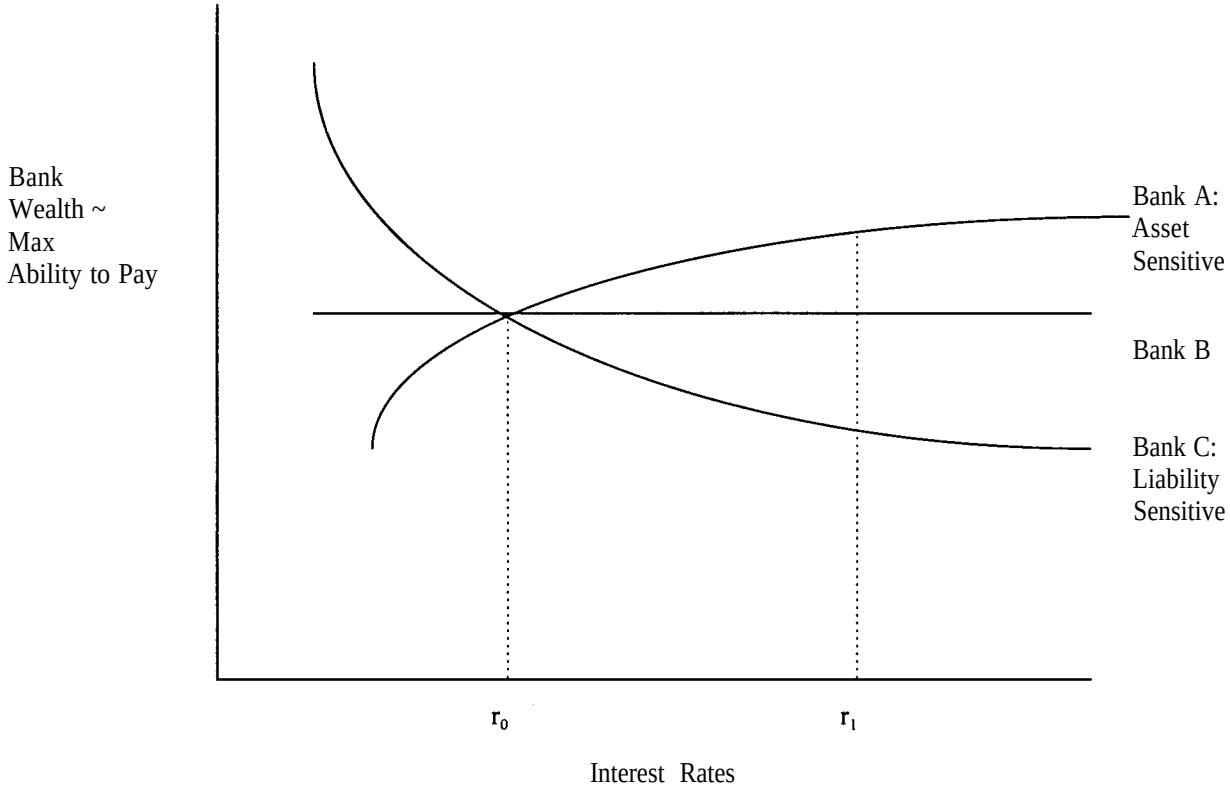


Figure 1: Schematic representation of the maximum-ability-to-pay for three potential acquirers, as a function of the interest rate environment.

Table 1
Correlations of Bank Merger Activity and Stock Market Indices, Interest Rates, and the Yield-Curve Spread

This table shows the correlations between the annual number and value of completed bank and non-bank mergers from 1981-1994 and stock market indices, interest rates, and the yield curve spread. "Large bank mergers" are defined as those for which total consideration paid exceeds $50 million. The number and value of transactions are as of the effective date of the merger. The stock market indices include the S&P 500 index and the S&P Money Center Bank Index; interest rates include the one- and ten-year Treasury rates; the yield curve spread is the difference between the ten and one-year Treasury rates. Correlations greater than 0.4 are significant at the 10% level and are indicated by an asterisk(*).

	Non-Bank Mergers		Bank Mergers		Large Bank Mergers	
	Number	*Value*	*Number*	*Value*	*Number*	*Value*
Stock market indices						
S&P 500	0.911*	0.346	0.430*	0.634*	0.674*	0.673*
S&P Money Center Banks	0.525*	0.612*	0.295	0.497*	0.747*	0.504*
Interest rates						
1-Year Treasury Bill	-0.788*	-0.282	-0.467*	-0.801*	-0.795*	-0.820*
10-Year Treasury Bond	-0.833*	-0.424*	-0.384	-0.681*	-0.722*	-0.715*
Yield curve spread						
10-1 year spread	0.421*	-0.156	0.516*	0.828*	0.707*	0.802*

Table 2
Annual Number and Value of Bank Merger Transactions

This table shows the number and value of all announced transactions from the SDC database, (a) for which the target is a commercial bank or bank holding company; (b) the total consideration offered is greater than $50 million, and (c) we can identify CUSIPs and stock prices on CRSP for either the target or acquirer. The top panel shows the number and total value of mergers are as of the announcement date of the transaction. The bottom panel shows the distribution of this sample by type of transaction: full mergers involve the complete purchase of a bank, while partial transactions typically involve the purchase of selected branches or other operations.

YEAR	NUMBER	VALUE $mil
1980	4	1,097
1981	17	5,012
1982	19	2,247
1983	45	8,611
1984	25	4,469
1985	37	8,562
1986	44	16,246
1987	35	14,725
1988	27	6,155
1989	31	11,390
1990	21	4,450
1991	38	21,288
1992	45	13,497
1993	49	15,726
1994	42	9,881
TOTAL	477	143,356

Number Value ($ mil)	Full mergers	Partial acquisitions	Total
Completed transactions	337 $105,490	65 $11,829	402 $117,319
Withdrawn transactions	72 $25,084	3 $954	75 $26,038
Total	409 $130,574	68 $12,783	477 $143,357

Table 3
Descriptive Statistics on Acquirer and Target Banks, 1980-1994

The table provides descriptive statistics for the sample of all bank mergers and acquisitions used in this paper. Interest-rate betas are calculated as the coefficients on the interest-rate factor from a two-factor model in which bank stock returns are regressed on the CRSP-value weighted index and the 10-year Treasury bond holding period returns. These betas are corrected for non-synchronous trading using Dimson (1977) and Fowler and Rorke (1983). Industry-adjusted betas represent the difference between the Dimson-beta and the mean Dimson beta for the banking industry, as described in the Appendix. The accounting measures were collected either from SNL Securities or from bank annual reports. Although there are a total of 423 acquirers and 360 targets, we do not have complete data for all banks and so sample sizes vary depending on the variable in question. The tests of differences represent t-tests of the differences between the mean values for targets and acquirers.

	Acquirers			Targets			Test of differences	
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	t-stat	p-value
Interest-rate beta	.060	.076	.241	-.011	-.009	.328	3.31	.00
Industry-adjusted interest-rate beta	.059	.071	.235	-.013	-.009	.315	3.50	.00
Size-adjusted interest rate beta	.022	.032	.237	-.030	-.030	.310	2.54	.01
Total assets ($billions)	$22.3	$11.0	$33.0	$6.7	$1.4	$20.0	7.23	.00
Return on average assets	1.02%	1.07%	0.46%	0.64%	0.84%	0.84%	6.58	.00
Book equity/assets	7.37%	7.18%	1.42%	6.90%	6.58%	2.11%	2.97	.00
Non-performing assets/total assets	1.30%	0.98%	0.99%	1.88%	1.32%	1.81%	4.68	.00
Non-interest expense/average assets	3.76%	3.67%	0.67%	3.65%	3.51%	1.02%	1.49	.14
Purchase price/target book value				197%	196%	49%		
Purchase price/target trailing EPS				18.2X	15.8X	9.2X		
Premium to target core deposits				10.3%	10.2%	5.2%		

Table 4
Target and Acquirer Industry-Adjusted Interest-Rate Betas

The tables below show the mean target and acquirer industry-adjusted interest-rate betas, calculated as the coefficients on the interest-rate factor from a two-factor model in which bank stock returns are regressed on market returns and the 10-year Treasury bond holding period returns. These betas are corrected for non-synchronous trading using Dimson (1977) and Fowler and Rorke (1983). To create industry-adjusted betas, we take the difference between the estimated betas and the mean industry beta for the same period, as described in the Appendix. The top panel shows the full sample, which includes both full and partial acquisitions, as well as completed and withdrawn transactions. The bottom panel examines full acquisitions only. Means are tested assuming unequal variances.

	Acquirers	Targets	t-stat	p-value
All transactions	0.059	-0.013	3.50	0.00
Full mergers	0.052	-0.012	2.95	0.00
Partial acquisitions	0.104	-0.025	2.00	0.05
t-stat (Full v. Partial)	1.50	0.23		
p-value	0.14	0.82		
Completed transactions	0.060	0.001	2.62	0.01
Withdrawn transactions	0.049	-0.076	2.62	0.01
t-stat (Compl. v. Withdrawn)	0.34	1.81		
p-value	0.74	0.07		

(All full mergers only)

	Acquirers	Targets	t-stat	p-value
Low rates	0.076	-0.012	2.12	0.04
Medium rates	0.032	-0.053	2.00	0.05
High rates	0.048	0.023	0.81	0.42
t-stat (Low v. Medium)	1.49	0.81		
p-value	0.14	0.42		
t-stat (Medium v. High)	0.49	1.86		
p-value	0.62	0.07		
t-stat (Low v. High)	1.05	0.77		
p-value	0.29	0.44		
Falling rates	0.056	0.020	1.08	0.28
Stable rates	0.022	-0.058	2.07	0.04
Rising rates	0.084	0.001	2.08	0.04
t-stat (Falling v. Stable)	1.18	1.81		
p-value	0.24	0.07		
t-stat (Stable v. Rising)	1.78	1.36		
p-value	0.08	0.17		
t-stat (Falling v. Rising)	0.94	0.43		
p-value	0.35	0.67		

Table 5
Target and Acquirer Interest-Rate Positioning
as a Function of the Interest-Rate Environment

The table below shows the relationship between unadjusted interest-rate betas and (a) the level of the 10-year Treasury yield in the month of the acquisition announcement, (b) the change in the 10-year Treasury yield from the average of the prior eleven months, (c) the steepness of the yield curve (measured by the yield differential between 10-year and 1-year Treasuries), and (d) the log of the size of the bank. This analysis jointly considers both targets and acquirers, with interaction terms for acquirers showing the difference between target and acquirer positioning. T-statistics are reported in parentheses, and are calculated using White (1980) robust standard errors, significance is noted as follows: * = 10%; **= 5%, and ***=1%.

Dependent variable: Unadjusted Interest-Rate Beta	
Constant	-.181
	(0.67)
Acquirer fixed effect	.302**
	(2.15)
Level of 10-year yields	.022**
	(2.42)
Acquirer dummy*Level	-.034***
	(2.65)
Trend in 10-year yields	-.030*
	(1.68)
Acquirer dummy*Trend	.040*
	(1.71)
Steepness of yield curve	.011
	(0.41)
Acquirer dummy *Steepness	.014
	(0.45)
Log of bank assets	-.001
	(0.13)
# of observations	515
Adj. R-squared	.025

Table 6
Cumulative Abnormal Returns (CARs) for Target and Acquirer Banks Involved in Acquisitions, 1980-1994

The table below presents mean cumulative abnormal returns (CARs) for banks that were targets or acquirers in the period 1980-1994. CARs for (-1,+1) are calculated using the methodology from Brown and Warner (1985). The top panel shows the full sample, which includes both full and partial acquisitions, as well as completed and withdrawn transactions. The bottom panel examines only full mergers whether ultimately completed or withdrawn. Means are tested assuming unequal variances.

	Acquirers	Targets	t-stat	p-value
All transactions	-0.010	0.127	12.31	0.00
Full mergers	-0.013	0.145	15.52	0.00
Partial acquisitions	0.009	0.009	0.01	0.99
t-stat (Full v. Partial)	4.45	2.65		
p-value	0.00	0.01		
Completed transactions	-0.009	0.124	10.14	0.00
Withdrawn transactions	-0.017	0.139	8.12	0.00
t-stat (Compl. v. W/D)	1.48	0.65		
p-value	0.14	0.52		

(All full mergers only)

	Acquirers	Targets	t-stat	p-value
Low rates	-0.014	0.128	8.4	0.00
Medium rates	-0.010	0.157	7.77	0.00
High rates	-0.016	0.146	11.22	0.00
t-stat (Low v. Medium)	0.68	1.03		
p-value	0.50	0.31		
t-stat (Medium v. High)	1.10	0.42		
p-value	0.27	0.68		
t-stat (Low v. High)	0.56	0.79		
p-value	0.58	0.43		
Falling rates	-0.011	0.142	8.38	0.00
Stable rates	-0.014	0.150	11.26	0.00
Rising rates	-0.016	0.141	7.61	0.00
t-stat (Fall v. Stable)	0.77	0.35		
p-value	0.44	0.73		
t-stat (Stable v. Rising)	0.26	0.40		
p-value	0.80	0.69		
t-stat (Falling v. Rising)	1.02	0.07		
p-value	0.31	0.95		

Table 7
Cross-Sectional Regression of Deal Pricing as a Function of Bank Characteristics and the Interest-Rate Environment

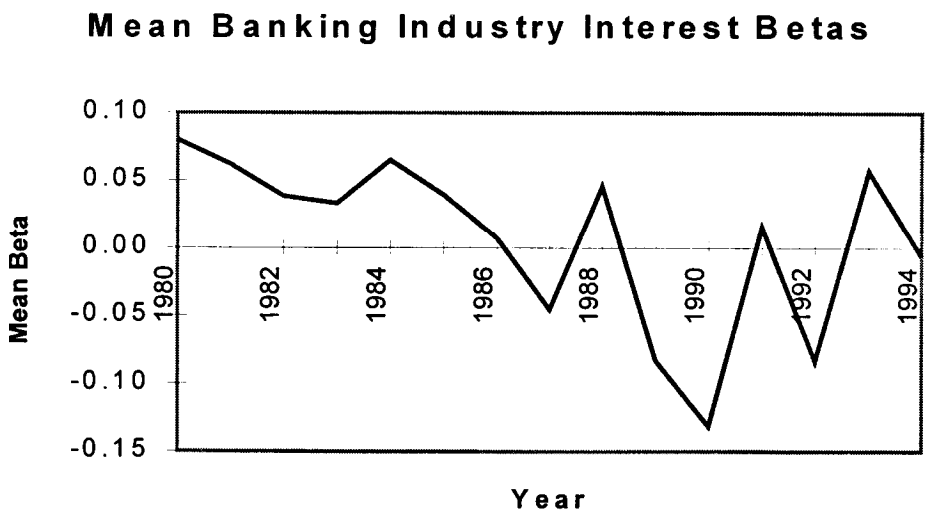
The table below analyzes five measures of the pricing of bank acquisitions in the period 1980-1994. The first two measures are cumulative excess returns to the target and bidder over the (-1,1) period, calculated using Brown and Warner (1985). The multiples reported as dependent variables are standard measures of the pricing of bank acquisitions, are and were provided by SNL Securities for deals announced in 1987-1994. The coefficient on inverse of bank size has been scaled by dividing by 1,000,000. T-statistics are calculated using White (1980) consistent standard errors, and significance is noted: * = 10% and **=1%.

	Dependent Variables				
	3-Day Excess Return		Purchase Price to Target Book Value	Purchase Price to Target Earnings/Share	Premium to Target's Core Deposits
	Target	Acquirer			
Constant	-0.145	-0.121 **	3.082 **	18.245 *	0.242 **
	(0.91)	(2.87)	(8.53)	(1.93)	(5.73)
Interest Rate Environment					
Level of Rates	0.018	0.006 *	-0.161 **	-0.370	-0.021 **
= current 10-year Treasury yield	(1.40)	(1.95)	(3.53)	(0.33)	(4.12)
Trend in 10-year Rates	-0.006	-0.006 *	0.116 *	0.130	0.016 **
= Current yield minus 12 month avg.	(0.40)	(1.99)	(2.08)	(0.09)	(2.71)
Yield Curve Spread	0.023	0.005	-0.148 **	-1.539	-0.014 *
= 10-year minus 1-year yield	(1.36)	(1.15)	(2.81)	(1.38)	(2.51)
Deal Characteristics					
Form of Consideration	0.092 **	0.012 *	0.006	4.450	0.012
= 1 if all cash	(2.99)	(1.90)	(0.05)	(1.17)	(1.11)
Intrastate Acquisition	0.027	0.014 *	0.079	0.726	0.004
=1 if intrastate merger	(1.07)	(2.27)	(1.01)	(0.43)	(0.54)
Post 1985 Deal	0.074	0.041 **			
=1 *if date is announced after 1985*	(1.29)	(2.62)			
Acquirer Merger Program		0.012 *	0.087	3.514 *	0.009
=1 if acquirer annouced merger in last year		(2.19)	(1.20)	(1.89)	(1.24)
Pooling Accounting	0.020	-0.015 *	0.196 *	1.695	0.027 **
=1 if deal uses pooling accounting	(0.68)	(2.20)	(2.51)	(1.17)	(3.40)
Target Financial Ratios					
Size = (1/Total Assets)	-1.086	6.9040 **	140.000 **	595.000	13.800 **
	(0.09)	(2.74)	(4.21)	(0.94)	(3.47)
Non-Interest Expense	0.716	-0.303	7.723 *	145.799	0.721 *
as % of Average Assets	(0.64)	(1.43)	(1.82)	(1.43)	(1.75)
Equity/Total Assets	-8.294 *	0.387	-9.768 **	73.991 *	0.049
	(2.17)	(0.94)	(3.46)	(1.73)	(0.18)
Equity/Assets*(Post 1984 Dummy)	8.296 *	-0.640			
	(2.23)	(1.43)			
Return on Average Assets	1.221	0.315	13.375	-684.608 **	1.846 *
	(0.43)	(0.78)	(1.26)	(2.68)	(2.58)
Non-Performing Assets	-0.501	0.218	-4.038	136.811 *	-0.373 *
as % of Total Assets	(0.70)	(1.19)	(1.47)	(1.82)	(1.76)
Number of Observations	192	223	134	113	132
Adjusted R-squared	12.9%	15.2%	37.0%	38.0%	45.3%
F Statistic	1.21	3.41	6.24	4.67	8.18

Appendix:
Bank Interest-Rate Sensitivity Over the Interest-rate Cycle

To examine the evolution of interest sensitivities over the 1980-1994 period, we collected a sample of all traded banks by putting together a comprehensive list of bank CUSIPs from the SDC database, COMPUSTAT (screened using bank SIC codes), and the *SNL Quarterly Bank Digest* (latest CUSIP list obtained directly from SNL). For each of these banks, we calculated interest-rate sensitivities over each calendar year using the methodology described in Section IV. The industry sample grows in size from 295 (in 1980) to 489 banks (in 1994) over the sample period.

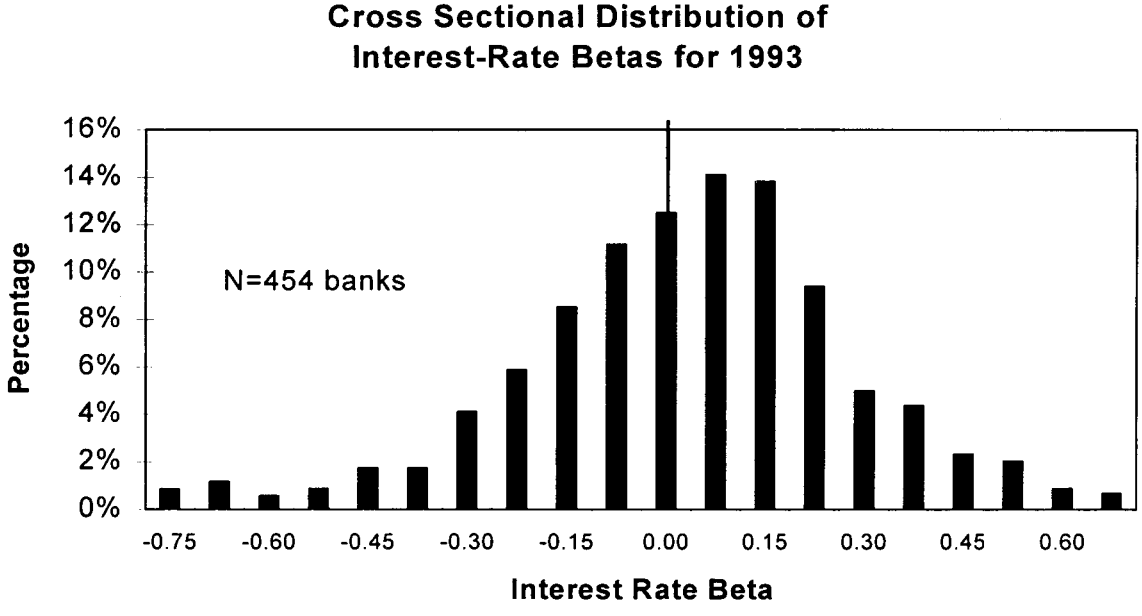
In each year, we calculate each banks' interest-rate sensitivity as the coefficient from a two-factor model of returns, using the Dimson (1979) and Fowler and Rorke (1983) and then calculate the mean and median for the entire sample. The figure below plots the mean interest-rate beta for each year from 1980 to 1994, which varies significantly over the period. (The medians are virtually indistinguishable.) Given the time-series variability, it is important to control for industry-wide changes in exposures. We calculated industry-adjusted sensitivities by subtracting the industry's mean interest-rate beta from each bank's interest-rate beta. We also calculated mean and median interest-rate betas for different size banks, where in each year banks were divided into one of four quartiles as a function of the market value of their equity at year end. We use these size-quartile data in constructing size-adjusted interest-rate betas.



The mean industry interest-rate beta is significantly correlated with the interest-rate environment. Specifically, we find that the mean beta is positively correlated with one and ten year yields (r = .58 and .55, respectively, with both significant at the .05

level), and with the standard deviation of one-year rates over the year (r=.49, p-value -.06). As rates go up and become more volatile, betas increase, i.e. banks become more liability-sensitive, or positioned for a rate fall. There is no significant correlation with either the steepness of the yield curve or the local trend in rates (rising, stable, or falling). We also examined the correlation between bank's interest rate betas and their market value. In 13 of 15 years, the relationship was positive, and in six of these significantly so. Overall, the correlation between bank size and exposures is .115, which is not significant at the 10% confidence level.

Finally, in addition to the time-series variability in betas, there is also substantial cross-sectional variation in betas in any given year. To give readers a sense of this variation, the figure below plots the distribution of interest-rate betas for a single year (1993).



In general, we find that the cross-sectional variation in betas increases over time, consistent with the notion that over the fifteen years that we study, the development of interest-rate risk management tools has given firms more latitude to set their interest-rate exposures, and that they have tended to set them divergently.