Working Paper 8605

RIVAL STOCK PRICE REACTIONS TO LARGE BHC ACQUISITION ANNOUNCEMENTS: EVIDENCE OF LINKED OLIGOPOLY?

By Gary W. Whalen and Richard L. Mugel

Gary W. Whalen is an economist and Richard L. Mugel is an economic analyst at the Federal Reserve Bank of Cleveland. The authors would like to thank John McElravey for his excellent research assistance and Steve Ruetschi for his systems and data support.

July 1986

Federal Reserve Bank of Cleveland

RIVAL STOCK PRICE REACTIONS TO LARGE BHC ACQUISITION ANNOUNCEMENTS: EVIDENCE OF LINKED OLIGOPOLY?

I. Introduction

In recent years, the number of intra- and interstate bank holding company (BHC) mergers and acquisitions has increased dramatically. For the most part, these have been market extension mergers, and have had little or no impact on local market concentration. Nevertheless, many observers have voiced concern over the competitive consequences of this trend toward geographical diversification and aggregate concentration. This paper examines one of the more prominent of these concerns -- linked oligopoly. In particular, **it** addresses the question: do multimarket contacts among geographically diversified bank holding companies adversely affect competition? This question is particularly relevant to the banking industry today because linked oligopoly is one of the economic arguments frequently used to justify existing barriers to interstate banking.

The linked oligopoly hypothesis holds that increased multimarket contact among geographically diversified bank holding companies may lead to a lessening of local market competition. According to the theory, BHCs operating in several different geographical markets are likely to shy away from vigorous competition in local markets out of fear that their rivals will retaliate in other markets, particularly markets in which they perceive themselves as being more vulnerable. Competing firms in this environment, it is argued, will develop a more benign, "live and let live" attitude toward one another. This behavior -- also known as mutual forbearance -- is seen as an outgrowth of rival firms' recognition of a mutual interdependence across markets.' In this way, then, the linked oligopoly hypothesis predicts that, as large BHCs come to meet each other in progressively more markets, competition in local markets will suffer.

A lessening of competition, however, is just one of several possible outcomes of increased multimarket contact. Solomon [12], for example, suggested that increased multimarket contact among BHCs could also lead to an increase in competition. Thus, in examining the competitive effects of multimarket contact among BHCs, one is presented with the possibility of two extreme outcomes -- increased competition on the one hand and reduced competition resulting from linked oligopoly on the other.

It was not until the late 1970s that researchers began to empirically investigate linked oligopoly and the competitive consequences of increased multiple market contact among competing firms. Relatively little empirical work has been done to date. Much of it has focused on geographical diversification in the banking industry. Most studies have employed the standard structure-performance paradigm of industrial organization to test the competitive impact of increasing intermarket linkages. They have used either accounting measures of profits, expressions of market rivalry or some other performance measure as dependent variables and various measures of multimarket contact as independent variables, controlling for other factors likely to affect performance, such as market concentration and growth. So far, results have been mixed: some of the early research suggested an anti-competitive effect consistent with linked oligopoly, while others have supported the existence of a pro-competitive effect or of no effect at all.' In view of the mixed results and the paucity of studies, the empirical literature has not been able to convincingly verify or dismiss the linked oligopoly hypothesis.

II. THE EVENT-STUDY APPROACH

In this paper, a somewhat different approach was used to examine the competitive effect of increasing multimarket links among large BHCs. An event-study framework similar to that used by Eckbo (3) was utilized to generate market-based estimates of the competitive impact of large, intrastate BHC acquisitions on rival holding company stock returns. The nature of the relationship between stock returns and multimarket links was then examined. By relying on market-based stock price data rather than accounting measures, some of the conceptual and practical difficulties associated with accounting measures of market performance were circumvented. This approach presumes that equity markets are efficient, that is, that all available information relating to a given firm's profitability is reflected relatively quickly in stock market returns. Another implicit assumption is that geographically diversified BHCs operate subsidiary units as part of an integrated entity.[3]

According to event-study literature, abnormal stock returns around merger announcements provide information on shareholders' expectations of the proposed merger's impact on revenue and cost conditions, and therefore profits, of both the acquiring firm and rival firms operating in the same industry.[4] Positive abnormal returns indicate an increase in the expected spread between revenues and costs, while negative returns indicate an expected decline. In efficient markets, moreover, the estimated impact of a particular event on the future profitability of a given firm should be reflected relatively quickly in its stock returns.

By following the paradigm used by Eckbo (3), abnormal stock returns accruing to rivals around acquisition dates can be examined for information on whether or not investors expected the mergers to generate collusive, anti-competitive effects. If a merger is pro-competitive, providing the acquirer with a cost advantage, rival BHCs' future profits should be dampened and rival abnormal returns should be negative. If, on the other hand, a given merger will have an anti-competitive effect -- that is, it creates a collusive environment -- rival firms may be expected to earn increased profits. This, in turn, should be reflected in positive abnormal returns accruing to rivals around the announcement date. This provides the necessary condition for an anti-competitive linked oligopoly effect -- positive abnormal returns accruing to rival BHCs around merger announcements.[5]

In this paper, abnormal returns of rival BHCs around large BHC merger announcements were estimated and cumulated in a narrow interval around the announcement date in order to isolate the impact of the merger announcement on the expected profitability of rival BHCs. Cumulative abnormal returns of rival BHCs were then related to changes in intermarket linkage measures similar to those used by previous researchers. If linked oligopoly in fact exists, and if increases in multimarket links between BHCs adversely affect competition, merger announcements that would increase the number of multimarket linkages between dominant BHCs should prompt shareholders to revise upward their expectations of rival BHC profitability. This, in turn, should be reflected in positive abnormal stock returns accruing to rival BHCs. Larger increases in links, moreover, should be associated with higher positive abnormal returns.

III. Sample and Methodology

Sample

The sample is nonrandom. The states examined were those where a relatively large number of sizable BHC acquisitions had taken place in recent years. States that had recently changed their intrastate or interstate branching law in any material way were excluded. The final sample was drawn from six states: Ohio, Wisconsin, New Jersey, Missouri, Texas and Michigan. The dominant rivals in each of these states were defined to be at least the five largest BHC's headquartered there (all with total assets in excess of $1 billion). Several other large BHC's were included in states where they existed. This process yielded a total of 39 rivals -- 8 in Ohio, 5 in Wisconsin, 6 in New Jersey, 7 in Missouri, 7 in Texas and 6 in Michigan. In each of these states, all rival acquisitions of banking organizations larger than $250 million in total assets that took place since 1980 were then identified. This produced a total of 55 acquisitions for analysis -- 8 in Ohio, 7 in Wisconsin, 9 in New Jersey, 20 in Texas, 5 in Missouri, and 6 in Michigan. The Wall Street Journal and American Banker Indexes were used to identify the calendar dates on which each of the acquisitions was announced. Thus, announcement dates, rather than effective dates, were used as event dates.

Methodology

The relationship between rival cumulative abnormal returns (CARs) around acquisition dates, and multimarket linkages among dominant firms, was investigated in two alternate ways. First, following the procedure employed by Eckbo (3), the rival BHC's for each acquisition were pooled into equally weighted portfolios and the relationship between cumulative abnormal returns for the rival portfolios and aggregate linkage measures was explored. The aggregate linkage measures take only linkages between the top three BHC's in the state into account and so change only when one of these firms is involved in a merger. If large BHC intrastate acquisitions facilitate collusion, the bulk of these CAR measures should be positive, as should the cross-sectional average of these measures (CAAR). Further, if the linked oligopoly theory is correct, the positive CAR measures should be larger for acquisitions that increase the linkages between the dominant firms, or aggregate links, than for acquisitions which leave these linkages unchanged.

However, looking only at the relationship between returns to portfolios of rivals and aggregate links may not be the best way to investigate the linked oligopoly hypothesis. These acquisitions differ in a number of respects -- the size of the acquired institution, the year it took place, the state in which it occurred, the impact on the existing linkage pattern, the existing link pattern, etc. Thus, it might not be informative or appropriate to examine these acquisitions together as a group. More importantly, if one examines only portfolio returns, it is not possible to gain insight into the distribution of stock price responses across rivals. This makes it difficult to determine whether the responses observed are related to linkage changes or if they are due to other factors (such as takeover speculation).

In any investigation of the linked oligopoly hypothesis, specification of the linkage variables is crucial. Theory does not provide a great deal of insight on how this should be done. Obviously, the impact of any acquisition on the linkage structure in any state depends on the identity of the acquiring firm, on the characteristics of the acquired institution, and on how one chooses to measure linkages. It is possible that large firms other than the top two or three in any state could be considered "dominant" and that changes in linkages due to mergers involving these firms could impact competition. Therefore, the relationship between the abnormal stock price response of each rival and its linkages with the acquiring institution before and after acquisition was also investigated.

If the mutual forbearance hypothesis is correct, rivai abnormal stock returns should be positively related to changes in the number of such links. However, the competitive impact of a given increase in links realistically should depend on the level of linkages prevailing prior to the acquisition announcement as well. A critical or threshold level of linkages might exist; increases in linkages might result in recognition of mutual interdependence only when links increase above this level. Thus, the relationship between each rival's abnormal returns, a linkage change variable, and an interaction variable -- the product of the change and the pre-acquisition linkage level -- was also investigated. The mutual forbearance hypothesis suggests that both the linkage change variable and the interaction term should be positively related to rival CAR's, cet. par.

A key presumption in both approaches is that the rival stock price reactions are not attributable to increases in concentration within markets and the creation of horizontal market power. There were several reasons for this view. First, the sample was restricted to BHC merger announcements, which must be approved by the Federal Reserve. As a result, merger proposals that would substantially increase local market concentration should be screened out. In fact, this proved correct. Very few of the events in the sample resulted in any material increase in local market concentration. Of the 55 mergers in the sample, there were only eight in which the three-firm concentration ratio (CR3) increased by five or more percentage points in any one

SMSA and only nine in which the CR3 increased by a similar amount in any one county. In addition, the impact of changes in local market concentration on rival stock price reactions was investigated empirically. No discernible effect was evident.

Calculation of Abnormal Returns

After the merger announcement dates were identified, daily stock price data for each rival and also for the Standard and Poor's 500 and OTC bank stock indexes were obtained from the DRI stock price database. These data were used to construct continuously compounded daily return series, which in turn were used to generate the abnormal returns for each rival and equally weighted portfolio of rivals around each acquisition date.

The specific procedure was as follows. A two-factor market model was estimated for each rival and portfolio of rivals for each acquisition date using OLS." The two-factor version was employed to control for any industry effect impacting bank returns over this interval.[7] **It** had the following general form:

$$(1) \qquad R_{i,t} = A_i + B_{1,i}RM_t + B_{2,i}RB_t + e_{i,t}$$

where $R_{i,t}$ = continuously compounded daily stock return for the ith rival or ith portfolio of rivals

RM_t = the continuously compounded daily return on the S&P500 index

RB_t = the continuously compounded daily return on the OTC bank stock index

$e_{i,t}$ = a random error term with standard properties

A_i, $B_{1,i}$ and $B_{2,i}$ are regression coefficients to be estimated

This model was estimated using returns beginning one year before and ending 120 days prior to the acquisition announcement date. Predicted returns generated using this equation and actual index returns on days surrounding the acquisition announcement or event date are defined to be normal returns for each rival or the portfolio of rivals. The difference between the predicted return on any day and the actual return is defined to be the abnormal return that is presumably due to the rival acquisition announcement. These abnormal returns are then summed over narrow intervals around the acquisition announcement date to produce cumulative abnormal return measures that are the focus of the analysis.[8]

Linkage Measures

Numerous linkage measures, similar to those used in previous studies, were constructed. For each acquisition, the linkage measures were calculated using data from the Summary of Deposit report closest to that acquisition date. Both aggregate linkage measures and linkage measures of each rival with each acquiring firm were created. For some measures, rival rankings were considered as well. For example, for certain measures, a link was only presumed to exist if both the acquiring and rival firms were in the top three in a given geographic unit, if both were in the top five or where either was in the top five. The linkage measures were defined using three alternative geographic bases: counties, SMSAs and, to crudely approximate banking markets, SMSAs and rural counties. Measures were also constructed where a presence was presumed to exist as the result of an announced, but as yet uncompleted, acquisition. Since the competitive impacts of the acquisitions are presumed to be reflected in investor expectations of changes in future profits, and since the acquisition announcements are clustered to some extent, such linkage measures might be more appropriate. The definitions of the linkage measures employed are detailed in tables 1 and 2.

IV. Results

Portfolio CAARS and Aggregate Links

An attempt was made to replicate Eckbo's analysis for the sample of rival BHC's. The cumulative abnormal returns for equally weighted portfolios of rivals were averaged cross-sectionally to crudely investigate the competitive impact of the acquisition announcements. Collusive merger impacts are suggested by positive abnormal rival returns. Specifically, averages were calculated separately for mergers in which so-called aggregate linkages measures changed and for events in which they did not change. The results of this exercise are summarized in table 4." With one exception, the results appear to support the existence of the mutual forbearance hypothesis. Specifically, CAARs, for cases when there is no change in the aggregate linkage measures, are positive, but generally not significant. In events where the linkage measures increased, the CAARs are considerably larger and significantly different from zero. In particular, the results in the bottom part of the table are notable because the linkage measure AL2 may be a better linkage measure than AL1.

Rival CARs And Their Links With the Acquiring BHC

The relationship between rival CARs around acquisition dates and their linkages with the acquiring institution was also explored using regression analysis. Specifically, regressions were estimated in which the rival CARs for a particular acquisition were presumed to depend on the change in their linkages with the acquiring institution. Regressions were also estimated with an interaction term (the product of the change in links and the level of links prevailing prior to the announced acquisition) included. This specification allows the impact of a change in links to vary with the level of links in existence at the time the acquisition is announced.

The strongest indication that large acquisitions are creating conditions conducive to mutual forbearance would be a positive coefficient on the change in link variable and on the the interaction term when it is included as well. The strongest evidence against the linked oligopoly hypothesis would be negative coefficients on both terms. Differently signed coefficients on the two terms, when both are included in the estimated equation, suggest that the impact of a given change in links differs depending on a rival's level of existing links. In particular, a positive coefficient on the change variable, and a negative coefficient on the interaction term, suggests that the size of the rival CAR response to a unit change in links is smaller, the higher the level of pre-acquisition links with the acquiring institution. This implies a negative CAR response to an increase in links for rivals with pre-acquisition links above some threshold level. Such a finding would appear to contradict the mutual forbearance hypothesis. It also might indicate that takeover speculation rather than any linked oligopoly effect is responsible for the positive significant rival portfolio returns previously reported. That is, positive CAAR's for portfolios of rivals may primarily reflect positive CAR's of smaller rivals. Such rivals tend to have lower levels of existing links with any acquiring competitor, and after a major acquisition is announced, investors may view such firms as the most likely future acquisition targets.

Several different versions of the basic regression equation were estimated with a variety of nonlinkage explanatory variables included. For example, various absolute and relative size variables (bidder, rival, target), a local market concentration change dummy and year-of-acquisition dummies were added to the basic equation. Presumably, the latter pick up the effects of actual or expected growth in the various states or interstate banking expectations. Neither size variable nor the concentration change dummy was even marginally significant. Including these variables did not affect the estimated coefficients on the linkage variables, and so do not appear in any of the equations reported. The year dummies appear in reported equations when at least one was significant. Inclusion of the year dummies also did not generally alter the estimated coefficients on the linkage variables in any material way.

The regressions were estimated for each of the six states individually to avoid problems encountered in pooling. The states are heterogeneous, and slightly different time periods are represented in each, so pooling was deemed inappropriate. It also appeared to be desirable to examine the nature of the relationship between rival returns and linkages in each of the six states rather than some average effect across states. However, this approach meant that, in several states, the number of degrees of freedom available was quite low.

The regression results for Texas are presented in tables 5 and 6. This was the state with the largest number of acquisitions and observations in the sample. Also the bulk of the acquisitions in Texas occurred prior to 1984, so expectations of the passage of interstate banking legislation should not affect the results in any way. In addition, Texas is a unit banking state where the thrift presence is not as great as in other states (such as Ohio), so the environment in such a state would seem to be most conducive to linked oligopoly.

A positive significant relationship between the change in link variable and rival CARs was found in Texas. This result did not appear to be sensitive to the linkage measure employed. However, when an interaction term was added to the regression equation, its estimated coefficient was significant and the explanatory power of the estimated equations improved. Thus, this is the form of the equations reported and discussed.

In the estimated equations, the coefficients on the linkage change variable and interaction term are positive and negative, respectively, and both are statistically significant. This finding implies that acquisitions that increase linkages are not always associated with positive rival returns. Rather an increase in linkages can be associated with a decline in the returns of rivals whose existing links approach or exceed a threshold level that varies depending on how linkages are defined. In the case of simple tallies for counties (table 5, equation 1), this level is approximately 11, a value below the maximum number of rival-acquiring firm links in Texas.

Similar, but somewhat stronger, results are evident for linkage measures that take rival and bidder size rankings into account (see table 5, equations 2 and 3). For example, the statistical significance of the linkage change and interaction term coefficients are considerably higher in the equation in which links are presumed to exist only if the rival and acquiring BHCs are both among the three largest organizations in the county. This improvement is not unexpected. Several researchers have emphasized that the relative size of competitors in any market influences their perception of mutual interdependence and thus the intensity of competition.

If the linkage measures are recomputed to reflect the impact of announced, but uncompleted acquisitions, the signs of the estimated coefficients again are unchanged and become even stronger statistically (see table 6). And again, the linkage measures that take account of relative size yield somewhat stronger results.

Thus, the results for Texas suggest that BHC acquisitions are not creating conditions conducive to linked oligopoly.

In Wisconsin, similar results were obtained despite a much smaller number of observations (see table 7). Both the change and interaction term are typically significant in the estimated equations with the same pattern of coefficient signs seen for Texas.

The results in the other states were more varied. In Michigan, again a state with a limited number of observations, results similar to those reported above were obtained (see table 8). The same pattern of signs was observed: positive on the change and negative on the interaction term. However, these results were only significant in equations where the rival CAR measure, defined over the -3 to +3 interval, was used as the dependent variable. The year dummies were never significant in Michigan and so do not appear in the regressions reported.

In Ohio, although the signs of the estimated coefficients on the linkage change and interaction variables were in line with those reported above, neither was generally significant. However, there was one exception. When links were defined using SMSAs and rural counties as the units of analysis, both of the coefficients were significant and the signs were unchanged (see table 9, equation 1). One reasonable explanation for the increase in significance when the SMSA-rural county linkage measures were used is the fact that, since 1979, Ohio banks have enjoyed more liberal branching privileges than those in the other states (with the exception of New Jersey) in the sample. When a large banking organization is present in a given SMSA in Ohio, it can and typically has branched widely throughout all the counties that comprise it. Thus, the competitive position of a BHC in Ohio is probably better represented by SMSA-rural county linkage measures than by county measures.

The results in Missouri generally differed from those in the states previously discussed. In Missouri, only the linkage change variable was significant and only in equations where the rival CAR's defined over the -3,+3 interval are used as the dependent variable (see table 9, equation 2). The estimated coefficient is positive. The interaction term is never significant, although it typically exhibits a negative sign. Thus, the evidence in Missouri is not inconsistent with the existence of linked oligopoly.

Finally, in New Jersey, neither the change nor the interaction term was found to be significantly related to rival returns, no matter how linkages were measured (see table 9, equation 3). Once again, the pattern of the coefficient signs was the same. There are several possible explanations for the absence of a significant relationship between rival CAR's and linkages in New Jersey. Given its proximity to New York and Philadelphia, New Jersey banks undoubtedly are influenced by the large banks in both of these areas. Thus, structural conditions in New Jersey per se may not be important determinants of the behavior of New Jersey banks. In addition, New Jersey contains only 21 counties and statewide branching has been permitted for some time. As a result, most of the rivals faced each other in a large proportion of the counties throughout the state at the outset of the period examined.

Previous researchers have suggested that, if this is the case, dominant firms might view the entire state as one market and linkages might not affect their behavior. Given both of these circumstances, the absence of a strong relationship between linkage changes and rival returns in New Jersey over the period of observation is not surprising.

V. CONCLUSION

The empirical findings at first glance appear to be mixed. Analysis of the cumulative average abnormal returns for portfolios of rivals suggests that BHC acquisitions that cause linkages among the three dominant firms to increase may cause competition to diminish through a linked oligopoly effect. However, these results could also reflect the impact of takeover speculation on the stock returns of smaller rivals. Given the additional set of empirical results generated using the regression approach, the latter interpretation of these findings appears to be more likely.

When the relationship between individual rival cumulative abnormal returns and changes in linkages with the acquiring BHC is examined, the findings do not seem to be consistent with the linked oligopoly hypothesis. The results indicate that an increase in links is associated with higher abnormal returns, but the positive impact of an increase in links declines, the higher the rival's level of preacquisition links with the acquiring institution. In fact, the magnitude of the estimated coefficients implies that a linkage increase is associated with negative abnormal returns for certain companies in the sample. Such a finding seems to be in line with the results reported by others investigating the linked oligopoly hypothesis using different approaches, i.e. large numbers of links tend to stimulate rather than mute competition.

In sum, the results of the study suggest that acquisition-related increases in multimarket linkages among BHC's do not lead to mutual forbearance. This, in turn, implies that the increase in aggregate concentration expected in the interstate banking era is unlikely to have materially adverse impacts on competition.

Footnotes

1. The notion of an anti-competitive, linked-oligopoly effect was first articulated by Corwin Edwards (1955). It was one of several possible consequences of conglomerate bigness discussed in his 1955 paper, and was advanced without rigorous theoretical or empirical support.

2. A recent review of the literature can be found in Alexander (1985), pp. 123-125.

3. Available evidence suggests that this is the case. See Whalen (1981).

4. For a detailed discussion of this approach, see Eckbo (1983) and Eckbo (1985).

5. As Eckbo (1983) pointed out, however, positive abnormal returns accruing to rival firms do not provide a sufficient condition for an anti-competitive effect. Rival BHCs could earn positive abnormal returns around competitive mergers if the acquisition announcement provides new information about markets or generates speculation about potential acquisitions.

6. This method of calculating abnormal returns was used for a variety of reasons. Brown and Warner (1985) have shown that this approach is generally superior to others. No explicit attempt was made to adjust for the problem of nonsynchronous trading. In event studies where this has been done, the empirical results are generally unchanged.

7. A number of researchers have argued that the two-factor specification is appropriate when banks are analyzed using the event-study technique. See Eisenbeis et al. (1984), for example.

8. There are two reasons why narrow intervals were examined. In efficient markets, stock prices should rapidly reflect investor expectations of the impact of any new information. Second, in some cases in the sample, consecutive acquisition announcements in a given state were separated by as few as seven days.

9. The test statistics are z values, developed using the approach detailed in Eckbo (1983), footnote 12, pp. 251-252.

References

Alexander, Donald L. "An Empirical Test of the Mutual Forebearance Hypothesis: The Case of Bank Holding Companies." Southern Economic Journal, vol. 52, July 1985, pp. 122-140

Brown, Stephen and Warner, Jerold. "Using Daily Stock Returns: The Case of Event Studies." Journal of Financial Economics, vol. 14, no. 1, March 1985.

Eckbo, B. Espen. "Horizontal Mergers, Collusion, and Stockholder Wealth." Journal of Financial Economics, vol. 11, nos. 1-4, April 1983, pp. 241-273

Eckbo, B. Espen. "Mergers and the Market Concentration Doctrine: Evidence from the Capital Market." Journal of Business, vol. 58, no. 3, July 1985, pp. 325-349.

Edwards, Corwin D. "Conglomerate Bigness as a Source of Power," in NBER Business Concentration and Price Policy. Princeton University Press, 1955, pp. 331-359.

Eisenbeis, Robert; Harris, Robert; and Lakonishok, Josef. "Benefits of Bank Diversification: The Evidence from Shareholder Returns." Journal of Finance, vol. 39, no. 3, July 1984, pp. 881-894.

Feinberg, Robert M. "Sales at Risk: A Test of the Mutual Forebearance Theory of Conglomerate Behavior." Journal of Business, vol 56, no. 2, April 1985.

Heggestad, Arnold A. and Rhoades, Stephen A. "MultiMarket Interdependence and Local Market Competition in Banking." Review of Economics and Statistics, no. 60, November 1978, pp. 523-532.

Mester, Loretta J. "The Effects of Multimarket Contact on Savings and Loan Behavior." Working Paper 85-13, Federal Reserve Bank of Philadelphia, 1985.

Rhoades, Stephen A. and Rutz, Roger D. "The Impact of Bank Holding Companies on Local Market Rivalry and Performance." Journal of Economics and Business, vol. 34, no. 4, 1982, pp. 355-365.

Scott, John T. "Multimarket Contact and Economic Performance." Review of Economics and Statistics, vol. 64, August 1982, pp. 368-375.

Solomon, Elinor H. "Bank Merger Policy and Problems: A Linkage Theory of Oligopoly." Journal of Money, Credit and Banking, vol. 2, August 1970.

Whalen, Gary W. "The Operational Policies of Multibank Holding Companies." Economic Review, Federal Reserve Bank of Cleveland, Winter 1981-82, pp. 20-31.

14. Whitehead, David D. and Luytjes, Jan. "Can Interstate Banking Increase Competitive Market Performance? An Empirical Test." Economic Review, Federal Reserve Bank of Atlanta, January 1984, pp. 4–10.

15. Whitehead, David D. "An Empirical Test of the Linked Oligopoly Theory: An Analysis of Florida Holding Companies." Working Paper Series, Federal Reserve Bank of Atlanta, June 1978.

TABLE 1

Definition of Link Measures:
Links with Acquiring BHCs

L1i = number of markets in which rival and acquirer meet.

L4i = change in L1i that would result from the proposed merger.

L6i = number of markets in which rival and acquirer meet, counting links only when both are in the top three.

L8i = change in L6i that would result from the proposed merger.

L9i = number of markets in which rival and acquirer meet, counting links only when both are in the top five.

L11i = change in L9i that would result from the proposed merger.

L12i = number of markets in which rival and acquirer meet, counting links only when either BHC is in the top 5.

L14i = change in L12i that would result from the proposed merger.

For each link concept above, interaction terms are symbolically represented as the product of the corresponding change and level variables: L1iL4i, L6iL8i, L9iL11i or L12iL14i.

Note: i = 1 indicates links calculated by SMSA.
i = 2 indicates links calculated by SMSA and rural counties.
i = 3 indicates links calculated by county.

TABLE 2

Aggregate Link Measures

AL1 = Number of markets in which BHC-rank 1 meets BHC-rank 2, BHC-rank 1 meets BHC-rank 3, and BHC-rank 2 meets BHC-rank 3.

AL2 = Number of markets in which BHC-rank 1, BHC-rank 2 and BHC-rank 3 all meet.

Note: Suffix "SMSA" indicates links calculated by SMSA. Suffix "CNTY" indicates links calculated by county

TABLE 3

Definition of Other Variables

PCAARij = cumulative average abnormal return for portfolio of rivals in percent, calculated over the interval beginning **i** days before and ending **j** days after the merger announcement date

CARij = cumulative abnormal rival return for individual rivals in percent, calculated over the interval beginning i days before and ending **j** days after the merger announcement date.

YRDij = 1 **if** the merger announcement occurred in the year 19ij, otherwise equal to zero.

TABLE 4

Aggregate Link Measures
and Portfolio Returns

A. Link Measure = AL1

	No Change in Links:		Increase in Links:	
	SMSA	County	SMSA	County
Return Measure	N=44	N=35	N=11	N=20
PCAAR11	+0.33	+0.54	+0.97	+0.32
	(1.04)	(2.02)	(3.25)	(1.28)
PCAAR33	+0.25	+0.32	+1.46	+0.80
	(1.03)	(1.17)	(2.74)	(2.02)

B. Link Measure = AL2

	No Change in Links:		Increase in Links:	
	SMSA	County	SMSA	County
Return Measure	N=49	N=45	N=6	N=10
PCAAR11	+0.34	+0.41	+1.44	+0.70
	(1.27)	(1.62)	(3.59)	(2.16)
PCAAR33	+0.22	+0.25	+2.68	+1.58
	(1.04)	(0.94)	(3.55)	(3.05)

Note: z values in parentheses.

TABLE 5

Regression Results: Texas

Dependent Var: CAR11

EQUATION 1:

VARIABLE	COEFF	T VALUE	F	DOF	RBAR
CONSTANT	.012659	1.87	2.53	7,87	.
L43	.018552	2.73			
L13L43	-.001564	-1.64			
YRD80	.000171	0.01			
YRD81	-.016105	-2.07			
YRD82	-.011015	-0.80			
YRD83	-.013581	-1.24			
YRD85	-.012924	-0.94			

EQUATION 2:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	.012854	1.93	2.96	7,87	.13
L83	.026531	3.55			
L63L83	-.004842	-2.16			
YRD80	-.000024	-0.02			
YRD81	-.018602	-2.40			
YRD82	-.007572	-0.57			
YRD83	-.009263	-0.92			
YRD85	-.010414	-0.78			

EQUATION 3:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	.011531	1.72	2.99	7,87	.13
L113	.017423	3.51			
L93L113	-.001788	-1.92			
YRD80	.001299	0.12			
YRD81	-.016187	-2.11			
YRD82	-.007715	-0.58			
YRD83	-.010109	-0.99			
YRD85	-.011145	-0.84			

TABLE 6

Regression Results: Texas"

Dependent Var: CAR11

EQUATION 1:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	.011737	1.94	2.69	7,87	.11
LA43	.020576	3.27			
LA1343	-.001940	-2.36			
YRD80	.001093	0.10			
YRD81	-.016061	-2.07			
YRD82	-.007711	-0.57			
YRD83	-.012064	-1.10			
YRD85	-.011165	-0.82			

EQUATION 2:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	.009606	1.44	3.44	7,87	.15
LA83	.030584	4.04			
LA6383	-.005335	-3.07			
YRD80	.003224	0.31			
YRD81	-.014217	-1.88			
YRD82	-.002902	-0.22			
YRD83	-.006688	-0.69			
YRD85	-.007173	-0.54			

EQUATION 3:

VARIABLE	COEFF	T VALUE	F	DOF	RBAR
CONSTANT	.010355	1.56	3.34	7,87	.15
LA113	.019347	3.93			
LA93113	-.002024	-2.68			
YRD80	.002474	0.24			
YRD81	-.014185	-1.86			
YRD82	-.005057	-0.38			
YRD83	-.009265	-0.92			
YRD85	-.010165	-0.77			

*The 'A' in the linkage measures in this table indicate that these measures take announced, but uncompleted, acquisitions into account.

TABLE 7

Regression Results: Wisconsin

Dependent Var: CAR11

EQUATION 1:

VARIABLE	COEFF	T VALUE	F	DOF	RBAR
CONSTANT	.019159	2.33	2.20	3,24	.12
L43	.064224	2.17			
L13L43	-.009845	-2.34			
YRD85	-.022047	-1.75			

EQUATION 2:

VARIABLE	COEFF	T VALUE	F	DOF	RBAR
CONSTANT	.017686	2.24	2.05	3,24	.10
L113	.026399	1.95			
L93L113	-.008955	-2.22			
YRD85	-.016903	-1.75			

EQUATION 3:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	.019385	2.47	2.22	3,24	.12
L143	.052779	2.24			
L123L143	-.009270	-2.37			
YRD85	-.023658	-1.83			

TABLE 8

Regression Results: Michigan

Dependent Var: CAR33

EQUATION 1:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	-.011535	-0.94	2.71	2,26	.11
L43	.011811	2.33			
L13L43	-.000901	-2.01			

EQUATION 2:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	-.006412	-0.52	2.56	2,26	.10
L113	.011811	2.08			
L93L113	-.002458	-2.03			

EQUATION 3:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	-.010813	-0.87	3.55	2,26	.15
L143	.011197	2.65			
L123L143	-.000964	-2.26			

TABLE 9

Regression Results: Ohio

Dependent Var: CAR11

EQUATION 1:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	-.015767	-1.66	2.79	6,46	.17
L42	.014459	1.94			
L12L42	-.002616	-2.20			
YRD81	.019302	1.76			
YRD82	.010550	0.79			
YRD83	.034095	2.54			
YRD84	.047560	3.36			

Regression Results: Missouri

Dependent Var: CAR33

EQUATION 2:

VARIABLE	COEFF	T VALUE	F	DOF	RBAR
CONSTANT	.008590	1.01	2.29	3,30	.11
L43	.012561	1.80			
YRD84	-.060809	-2.62			
YRD85	-.004067	-0.32			

Regression Results: New Jersey

Dependent Var: CAR11

EQUATION 3:

VARIABLE	COEFF	TVALUE	F	DOF	RBAR
CONSTANT	.000830	0.13	2.14	4,43	.09
L43	.005205	0.46			
L13L43	-.000210	-0.25			
YRD84	.008898	0.50			
YRD85	-.015145	-1.57			