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Merging Markets

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ABSTRACT

We study the causes and effects of the competition for order flow by U.S. regional stock exchanges. We trace the origins of competition for order flow to a change in the role of regional exchanges from being venues for listing local securities to being more direct competitors for the order flow of NYSE listings. We study the way regionals competed for order flow, concentrating on a series of stock-exchange mergers that occurred in the midst of this transition of the regional exchanges. The merging exchanges attracted market share and experienced narrower bid-ask spreads.

STOCK EXCHANGES CAN BE VIEWED as firms that compete on a number of interrelated dimensions including liquidity provision and price discovery. As part of this competitive process, exchanges attempt to exploit scope and scale economies in securities trading by listing new firms and by attracting volume in existing securities. The second objective is known in modern parlance as "competition for order flow" and has received increasing attention in recent years, both within the U.S. securities market and across international borders (see, e.g., SEC (1994).) The questions of interest include the extent to which competition for order flow is affected by information costs and regulatory barriers (Gordon and Bovenberg (1996), Smith (1991)), the manner in which exchanges compete for order flow (Battalio, Greene, and Jennings (1997), Easley, Kiefer, and O'Hara (1996), Battalio, Greene, and Jennings (1998)), and the effect that such competition has on execution costs (Lee (1993), Blume and Goldstein (1997)).

In this paper, we contribute to such queries by analyzing historical aspects of the competition for order flow by regional stock exchanges in the United States. We first document how regulatory and technological changes altered the role of the regional exchanges from being the listing location of local firms to being an alternative venue for trading NYSE-listed securities.

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We then analyze the manner in which the regionals competed for order flow, concentrating on the effects of a series of exchange mergers on trading volume and execution costs. We find that the merging exchanges attracted order flow and experienced narrower bid-ask spreads.

The organization of the paper is as follows: Section I describes the changing role of regional stock exchanges over time. Section II presents the empirical evidence on the competitive effects of the stock exchange mergers. Section III concludes, and includes some remarks about the implications of our results for pending exchange mergers.

I. The Changing Role of Regional Stock Exchanges

Perhaps the fundamental issue underlying our analysis is whether competition between stock exchanges is viable. Stigler (1961, 1964) is among the first to model the fact that the trading of a particular security tends to cluster in a single location. He attributes this phenomenon to the presence of economies of scale in information production and, therefore, in the price discovery process. Subsequent empirical analysis by Doede (1967) and Demsetz (1968) elaborates on the scale economies present in securities markets. Doede reports that the average operating costs of stock exchanges are a declining function of trading volume, indicating evidence of economies of scale in *exchange operations*. Demsetz finds that bid-ask spreads are a declining function of the rate of transaction volume, indicating economies of scale in the *market making* of a particular security.

In the presence of such scale economies, intuition as well as formal theory (Chowdry and Nanda (1991)) suggest that order flow will gravitate to the market with the lowest execution costs. Of course, execution costs have many dimensions (see, e.g., Ahn, Cao, and Choe (1997), de Jong, Nijman, and Roell (1995)). Moreover, a substantial body of analysis, much in the context of the home-market-bias in international investing, suggests that information costs and regulatory barriers can impede the ability of stock exchanges to compete for order flow simply by offering lower execution costs (see, e.g., Kang and Stulz (1997), Gordon and Bovenberg (1996), Smith (1991)).

A. The Initial Role of Regional Exchanges

The history of regional stock exchanges in the United States demonstrates that information costs and regulatory barriers can significantly affect the competition for order flow.[1] In the nineteenth century United States securities financing, ownership, and trading all tended to occur on a localized basis, indicated by the fact there were more than 100 regional exchanges (SEC (1963), p. 928). For example, Dilts (1941, p. 67) notes that for a secu-

[1] A good source of information on the development of regional stock exchanges is Cole (1944). See also Greenwood (1921), Kamm (1942), Merrill (1937), Smith (1936), and Walter (1957), as well as media articles such as *Business Week* (1947).

Table I

Securities Trading on Regional Stock Exchanges, circa 1929

This table reports the most heavily traded common stock for each of the nine regional stock exchanges in January 1929, where trading activity is gauged by the dollar value of trading volume. Rankings of trading activity are based on data from the *Bank and Quotation Record*. Dollar volume for a given security is estimated by multiplying the monthly number of shares traded times the closing price on the last day of the month. Corporate offices are from *Moody's Manuals*.

Exchange	High-Volume Firm	Corporate Office(s)
Baltimore	Consolidated Gas, Elec. Light & Power	Baltimore
Boston	American Telephone & Telegraph	Boston & New York
Chicago	Bendix Corp.	Chicago
Cleveland	India Tire & Rubber	Mogadore, Ohio
Detroit	Brown (John W.) Mfg. Co. (auto lamps)	Columbus, Ohio
Los Angeles	L.A. First National Trust & Saving Bank	Los Angeles
Philadelphia	United Gas Improvement Co.	Philadelphia
Pittsburgh	Pittsburgh Screw & Bolt Corp.	Pittsburgh
San Francisco	Transamerica Corp.	San Francisco

rity such as AT&T that was widely held by the 1940s, "During earlier years the ownership of stock was naturally centered in Massachusetts, where the telephone was invented and first financed." Indeed, the creation of most regional exchanges was associated with the initial public financing of the growing industries of the given region. For example, an exchange was opened in San Francisco in 1862 to list western mining firms and exchanges were established in Pittsburgh and Los Angeles at the turn of the century to trade newly issued oil stocks. Cole (1944, pp. 1–2) states that secondary markets were linked with the local issuance of securities because of the primitive state of communications technology:

> The prime reason for the simultaneous emergence of capital markets and securities exchanges was that the flotation of securities created needs which only the [local] exchanges could adequately satisfy at the time. Without telephones, telegraphs or teletypes, face-to-face bargaining was essential in effecting securities sales.

At least until 1929, the regional exchanges retained much of their local flavor. As Table I shows, on nine important regional exchanges the most heavily traded firms in January 1929 had their corporate offices in an area proximate to the exchange on which they were listed. Of the nine firms, only American Telephone & Telegraph, listed on the Boston Stock Exchange, also traded on the NYSE.

B. Evidence on the Changing Role of Regional Exchanges

After 1929, the composition of trading activity on the regional stock exchanges changed significantly. The regionals shifted from their traditional role of trading local securities and "began to serve as auxiliary markets for New York" *(Business Week* (1936)).

Cole (1944) and Doede (1967) suggest that one reason for the altered focus of the regional exchanges was a reduction in communication costs during the 1920s and the 1930s. For example, by 1930, the stock tickers of the NYSE and many regional exchanges operated on a coast-to-coast basis.[2] Similarly, the first cross-continent telephone service was instituted in 1915 (SEC (1952, p. 38)). Moreover, beginning in 1926, AT&T instituted a series of rate cuts that significantly reduced the cost of long-distance communication. Rates fell 35 percent between 1926 and 1929 and 60 percent over the period from 1925 to 1940.[3] In 1935 the development of the open-end teletype enabled over-the-counter dealers across the country to contact each other immediately (SEC (1963), p. 924).These reductions in communication costs lessened the forces directing the trading of a security to an exchange located near where a firm happened to do business, making security markets more national in scope.

Contemporary observers such as Cole (1944) and Merrill (1937), as well as more recent studies by Stigler (1964) and Simon (1989), argue that changes in securities regulation following the Great Crash of 1929 significantly affected the regional exchanges. Tightening of state blue sky laws as well as the heightened disclosure requirements of the newly imposed federal securities regulation, which effectively raised the listing standards of the regionals to those of the NYSE, induced many large, established firms to switch their listing to the NYSE. At the same time, the new regulations prevented regionals from distributing new issues and thus induced many smaller firms to list and trade instead on the unregulated over-the-counter market (SEC (1963, p. 916)), especially given the lower cost of communications discussed above.

Although the disclosure requirements of federal securities law lessened the number of firms listed on the regional exchanges, subsequent regulatory decisions better enabled the regionals to compete for order flow in NYSE listings. At the urging of the SEC, Congress in 1936 altered the Securities Exchange Act to allow Unlisted Trading Privileges whereby an exchange could trade any security that was already approved for listing on another exchange.[4] In a related action in the Multiple Trading Case of 1940, the SEC abrogated an NYSE rule that would have prevented NYSE members from trading NYSE-listed securities on a regional exchange (SEC (1941)). This

[2] See the *New York Times* (1926) and *New York Times* (1930).

[3] See, for example, Page (1941) as well as the *New York Times* (1929). We thank Susan Woodward for directing us to this line of inquiry.

[4] For background on the development of Unlisted Trading Privileges, see Kamm (1942, pp.165–168), and the SEC (1944, pp. 58–62).

Table II

Composition of Trading Volume on Regional Stock Exchanges

This table reports the composition of the trading volume on nine regional stock exchanges for selected months of 1929, 1939, and 1949. The nine regional stock exchanges are Baltimore, Boston, Chicago, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, and San Francisco. Cell entries report the fraction of total regional dollar trading volume. The data are from the *Bank and Quotation Record*. Dollar volume for a particular month for a given security is estimated by multiplying the monthly number of shares traded times the closing price on the last trading day of the month. For securities with no trading on that day, the midpoint of the bid-ask spread on the last trading day of the month is used. Calculations exclude firms with a missing price or bid-ask quote on the last day of the month. The regional only data are for those securities traded on a regional exchange(s) and not traded on either the New York Stock Exchange (NYSE) or the New York Curb Exchange (NY Curb). The data for NYSE and NY Curb comprise, respectively, securities traded on a regional exchange(s) and also traded on the NYSE or NY Curb.

	January 1929	January 1939	January 1949
Regional only	63.7%	23.4%	18.3%
NYSE	8.6%	63.4%	74.2%
NY Curb	27.7%	13.2%	7.5%
Total	100.0%	100.0%	100.0%

rulemaking better linked the regionals with the NYSE, because NYSE members who chose to trade on a regional exchange could access via direct wire the bid and ask quotes to supplement the information on actual trades that was provided by stock tickers (SEC (1940, p. 25)).

As an indication of the changing role of regional stock exchanges, Table II reports the composition of dollar trading volume on nine regional stock exchanges for three months: January 1929, January 1939, and January 1949. As shown in the table, the majority (63.7 percent) of trading in 1929 came from securities listed only on regional exchanges. By January 1939, however, the fraction of regional trading volume devoted to purely local securities had fallen to less than 25 percent. At this time, the majority of regional volume was in securities listed on the NYSE, indicating that the phenomenon of competition for order flow in U.S. securities markets dates back more than 50 years. The trend toward NYSE listings continues through the 1940s; by 1949, less than 20 percent of the trading volume on regional exchanges stemmed from local securities.[5]

The changing role of regional stock exchanges is further illustrated by the extended time series of listings reported in Figure 1. In 1938, the earliest year with data reported by the SEC, the regional stock exchanges actually had more listed securities than either the NYSE or NY Curb (renamed the

[5] To benchmark the estimates in Table II, note that the fraction of 18.3 percent reported for non–New York volume on nine regional exchanges in January 1949 compares with a fraction of 16.23 percent reported by the SEC for 22 regional exchanges for the entire year (SEC (1949, p. 37)).

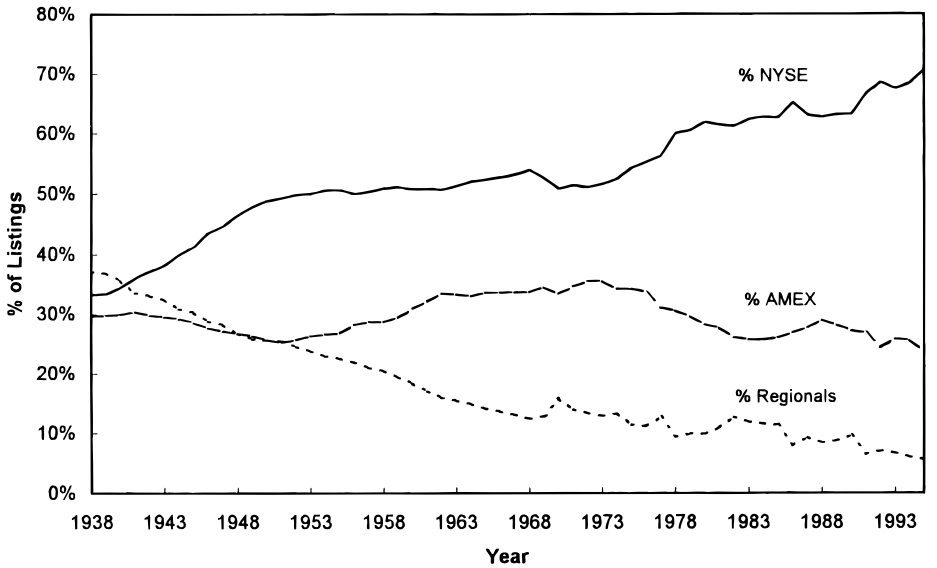

Figure 1. Listings on registered exchanges, 1938–1995. This figure plots the fraction of securities listed on the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), and the regional stock exchanges (Regionals) for the 1938 to 1995 period. Data are from reports of the Securities and Exchange Commission.

American Stock Exchange in 1953). The 1,412 securities on the regionals represented 37 percent of the listings on registered exchanges. Figure 1 shows, however, that the fraction of securities listed solely on the regional exchanges has steadily declined over time and currently represents less than 10 percent of the total listings on registered exchanges. Consistent with this pattern, the SEC (1963 p. 1074) reports that the market value of firms traded exclusively on the regionals declined from 2.1 percent of the market value of firms traded on the regionals in 1951 to one percent in 1961.

In spite of the steady reduction of regional-only listings, the regional stock exchanges have garnered an increasing share of the securities trading performed on registered exchanges in the United States over the past 50 years. As reported in Figure 2, the market share of the regional exchanges has risen from less than five percent in the 1930s to more than 10 percent in recent years. The combination of a decline in listings and an increase in market share confirms the importance of competition for order flow in NYSE listings for the makeup of regional trading activity.

II. Mergers as a Competitive Device

Through the 1940s, the technological and regulatory changes in U.S. securities markets had a major impact on regional exchanges, primarily because the changes enabled the over-the-counter market to effectively compete

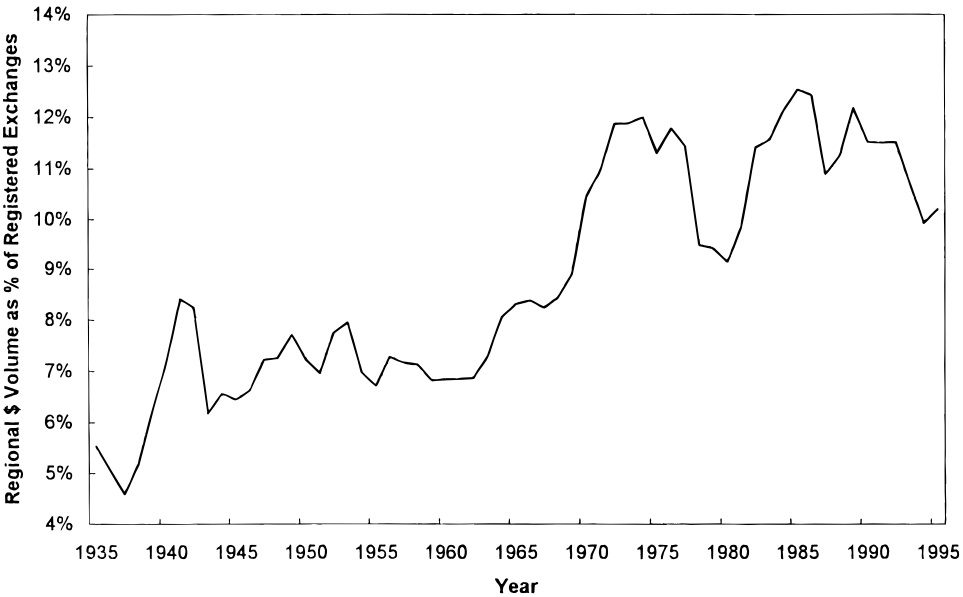

Figure 2. Market share of regional stock exchanges, 1938–1995. This figure plots the fraction of the dollar value of trading volume of registered exchanges that took place on the regional stock exchanges in the 1938 to 1995 period. Data are from reports of the Securities and Exchange Commission.

in roles where the regionals had historically concentrated. In response, the regional exchanges moved into increased competition on NYSE-listed stocks with each other and with the NYSE. Such competition appears to have occurred on a number of dimensions.[6] One avenue of competition was innovations in technology. The SEC credits the post-merger regionals with "trailblazing . . . new business procedures" (SEC (1963, p. 946)). Regional exchanges also relied on extended trading hours and the absence of transaction taxes to attract trades that otherwise might have been placed in New York. As noted by Jarrell (1984) and West and Tinic (1971), the regionals also obtained order flow via give-ups, expanded membership, and other means of surmounting minimum brokerage commissions.

The method of competition we study here is mergers. As described in Table III, the number of regional exchanges registered with the SEC fell from 18 in 1940 to seven in December 1980 to five today, and may fall even further. A major reason for this decline is a series of mergers beginning in 1949.[7]

[6] For a discussion of competition by the regionals following the creation of the SEC, see the SEC (1963, pp. 936–948). For a more historical discussion of the means by which other exchanges competed with the NYSE, see Garvy (1944).

[7] For background on the mergers of the regional exchanges, see Walter (1957) as well as the *New York Times* (1948), *New York Times* (1949b, p. 41), *Barron's* (1955, p. 5), *New York Times* (1956, p. 27), and the SEC (1963).

Table III

Registered Regional Stock Exchanges over Time

This table reports regional stock exchanges in existence at various points in time. The Midwest Stock Exchange was formed in December 1949 via the merger of the Chicago, Cleveland, and St. Louis Stock exchanges. The New Orleans Stock Exchange joined the Midwest in 1959. The Pacific Stock Exchange was formed in January 1957 via the merger of the Los Angeles and San Francisco exchanges. The Philadelphia-Baltimore Stock Exchange was formed in March 1949 via the merger of the Philadelphia and Baltimore exchanges, the Washington Stock Exchange joined in 1953, and the Pittsburgh Stock Exchange joined in 1969. The Detroit Stock Exchange liquidated in 1976.

December 1940	December 1950	December 1960	December 1970	December 1980
Boston	Boston	Boston	Boston	Boston
Cincinnati	Cincinnati	Cincinnati	Cincinnati	Cincinnati
Chicago Cleveland St. Louis	Midwest	Midwest	Midwest	Midwest
New Orleans	New Orleans			
Los Angeles San Francisco	Los Angeles San Francisco	Pacific	Pacific	Pacific
Baltimore	Philadelphia-Baltimore	Philadelphia-Baltimore	Philadelphia-Baltimore	Philadelphia
Philadelphia				
Washington (DC)	Washington (DC)			
Pittsburgh	Pittsburgh	Pittsburgh		
Detroit	Detroit	Detroit	Detroit	
5 others	4 others	4 others	3 others	2 others
18 total	14 total	11 total	9 total	7 total

In this paper, we study the effects of the first three mergers: the Philadelphia–Baltimore merger in March 1949, the Midwest merger in December 1949, and the Pacific merger in January 1957.[8] The Philadelphia and Baltimore exchanges merged into the Philadelphia-Baltimore Exchange; the Midwest Exchange (now named the Chicago Exchange) was formed by a merger of the St. Louis, Cleveland, and Minneapolis exchanges; and the San Francisco and Los Angeles exchanges merged into the Pacific Exchange. The Midwest and Pacific mergers were major mergers. The Philadelphia–Baltimore merger was relatively minor because the Baltimore Exchange was small; however, we include this merger because it occurred at essentially the same time as the Midwest merger and we want to control for these confounding events. The basic question we address is whether the mergers proved to be an effective means of competition. The data that we analyze, although

[8] Several other later mergers involve minor regional exchanges: Pittsburgh and Washington merged with the Philadelphia exchange and New Orleans merged with the Midwest exchange. We do not examine these mergers directly because they were minor and only very limited data are available on the minor partner in the mergers.

somewhat limited by modern standards, include trading volume, bid-ask spreads, and seat prices. The Appendix provides discussion of the specific nature and source of the variables used in the analysis.

Following Stigler's (1958) survivor principle, we first examine whether the merging exchanges attracted order flow and thereby improved market share compared to exchanges that chose not to merge. We next examine whether the mergers resulted in lower execution costs, as measured by bid-ask spreads. From the model and empirical results of Demsetz (1968) regarding economies of scale in market making, we expect any increase in volume induced by the mergers to translate into narrower bid-ask spreads. In related analysis, we examine whether and in what way the seat prices of merging exchanges and their competitors changed at the time of the mergers.

Because we are unable to obtain cost data we do not examine the effects of the mergers on the costs of operations of the merging exchanges. However, several earlier studies provide evidence on the costs of operations, at least after the mergers. Doede (1967) finds that from 1955 to 1965 the NYSE had much lower costs per dollar volume of securities traded than the American, Midwest, Philadelphia, and Pacific exchanges. The lowest average cost in any year, of any of the regional exchanges, was 40 percent higher than the highest cost per year by the NYSE, and the cost differences were usually much greater. Walter (1957, pp. 120–121) examines the changes in operating costs on a per-share basis for the Midwest and Philadelphia-Baltimore exchanges as a result of the mergers and finds that whether costs changed was "problematical." However, he also notes that operating expenses as related to shares traded or dollar volume were trivial. For example for the Midwest exchange for 1953 and 1954, operating expenses were one-tenth of one percent of dollar volume. Walter suggests that "the effect of consolidation upon transactions volume is far more crucial than its influence upon costs" (p. 121).

The effects of the mergers are related to the modes of competition for order flow discussed above, such as innovation, reduction of transfer taxes, and extended trading hours. In 1963 the SEC (1963, p. 946) documents that since its formation the Midwest Exchange had instituted the following significant innovations: admission of corporate members, an improved clearing system, reductions in communication costs, and a centralized bookeeping system.[9] In 1958 the President of the Pacific Exchange (Pacific Exchange (1958)) noted that the major focus of its major marketing campaign, "Trying Pacific," was the absence of any transaction tax in California. Walter (1957, p. 123), reports that after it was formed the Midwest Exchange began to emphasize that Illinois had no transfer tax. Further, 55 tax-free transfer agencies were established, which also shows the increased emphasis by the Midwest on NYSE-listed stocks. The president of the Pacific Exchange (Pacific

[9] William Lupien, CEO of the Pacific Exchange, says: "The Pacific Exchange is an industry innovator and has an established reputation for introducing new technologies that have literally transformed the stock transaction process" (Pacific Stock Exchange (1996)).

Table IV

Change in Trading Volume around Regional Exchange Mergers

This table reports the change in dollar trading volume for three regional stock exchange mergers. The columns show the month of the particular merger; the percentage change in dollar trading volume for the merging exchanges from the month prior to the merger to the month after the merger, the comparable change for all other registered stock exchanges, and the difference between the percentage change of the merging exchanges and all other exchanges (the net change). The data on dollar trading volume used to compile the table are from SEC reports.

Merger	Month	Percentage Change	All Other	Net Change
Midwest	December 1949	+60%	+36%	+24%
Pacific	January 1957	−6%	−12%	+6%
Philadelphia-Baltimore	March 1949	+23%	+17%	+6%

(1957, p. 4)) noted that the Pacific merger enabled the new exchange to better take advantage of the "natural endowment" of the three time zone difference between the East and West Coasts.[10]

A. Analysis of Trading Volume and Market Share

We first estimate the short-run change in dollar trading volume on the merging exchanges from the month before the merger to the month after the merger vis-à-vis the change in volume on all other registered exchanges over the same time interval. The data are constructed such that the volume for exchanges that later merged are pooled in the premerger period. Table IV reports the results.

As the table shows, the Midwest merger leads to a 60 percent increase in volume, compared to a 36 percent increase on all other exchanges, or a net increase of 24 percent.[11] The Pacific merger is associated with a 6 percent decline in trading volume, but because volume on all other exchanges falls 12 percent, this represents a net increase of six percent. The Philadelphia-Baltimore merger leads to a 23 percent increase in trading volume, which exceeds the increase on all other exchanges by six percent. In the short run, therefore, relative volume increases for all three merging exchanges.

[10] In a survey of dual members, the SEC (1963, p. 1086) finds that the number one reason for trading on the Pacific Exchange was a better price, followed by the ability to trade after the NYSE closed; on the Midwest Exchange the primary reason was that the price was as good as on the NYSE, followed by (tie) the saving on transfer tax and retention of a higher percentage of commissions; on the Philadelphia Exchange number one was to retain a larger percentage of commissions, followed by a reciprocal agreement with another regional member.

[11] In the month before the merger 53.4 percent of the share volume on the Chicago Exchange and 14.9 percent of the share volume on the Cleveland Exchange were in NYSE-listed stocks. In the month after the merger 63.8 percent of the share volume on the Midwest Exchange was in NYSE-listed stocks.

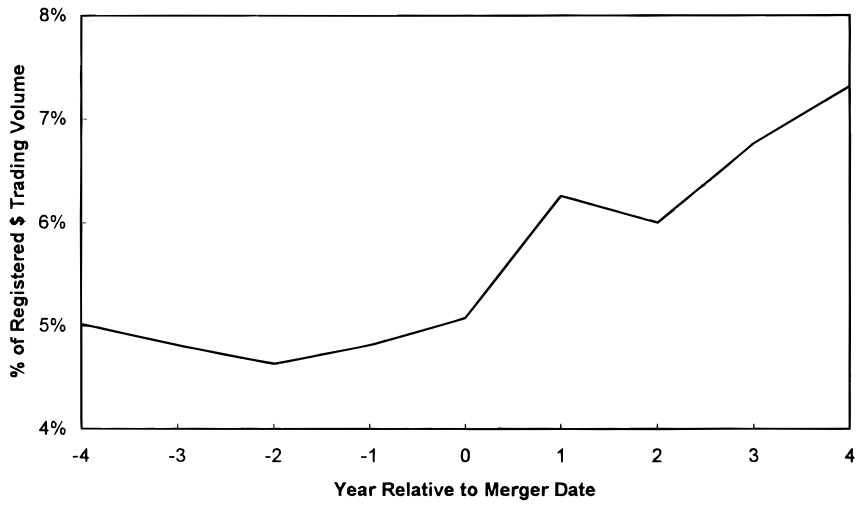

Figure 3. Event study of the market share of merging regional exchanges. This figure plots the fraction of the dollar value of trading volume of registered exchanges that took place on the regional stock exchanges involved in the formation of the Midwest, Pacific, and Philadelphia-Baltimore stock exchanges. For each exchange, year 0 is the year of the particular merger. Data are from reports of the Securities and Exchange Commission.

For a related analysis of the effect of the mergers, Figure 3 provides an "event study" of the change in market share of dollar volume of the merging exchanges from four years prior to merging through four years following, with year 0 being the year of the merger. Because market share is analyzed, the data effectively control for overall changes across all stock exchanges. Figure 3 indicates that the market share of the three merging exchanges increases from approximately five percent in the four years prior to the mergers to approximately seven percent by the fourth year following the mergers. This is consistent with the short-run evidence reported in Table IV.

Rudimentary "survival" analysis suggests that the mergers were successful in attracting market share, at least in comparison to the regional exchanges that did not merge. The two regionals with the greatest market share at present, the Midwest and the Pacific, were the products of mergers. By contrast, the Boston Stock Exchange, which did not merge, saw its status among regional exchanges decline over time. Even more noticeably, the Detroit Stock Exchange, which chose not to join the Midwest merger, liquidated soon after the elimination of minimum commissions on the NYSE in the mid-1970s.

B. Regression Analysis of Market Share

We conduct regression analysis of the effect of regional exchange mergers on market share to formally test whether the mergers had a statistically significant effect on market share. The analysis also addresses whether any

market share attracted by the merging exchanges came from the other, nonmerging regional exchanges or instead was drawn from the New York exchanges.

In addition to the exchanges involved in a merger, the analysis includes regression analysis explaining market share on other exchanges—their competitors for order flow.[12] The analysis uses monthly data for the period from four years prior to the merger to four years following the merger.[13] The effects of the Philadelphia–Baltimore and the Midwest mergers are estimated jointly because the two mergers occurred close together in time.

The dependent variable in each equation is the dollar market share of the particular stock exchange. For those exchanges involved in mergers, the premerger values of the dependent variable are the summed market shares of the merging exchanges. The explanatory variables include dummy variables to represent the effect of a given merger and a time-trend variable, which controls for other market influences. There are two dummy variables used in the regressions reported in Table V: the Philadelphia–Baltimore dummy takes the value one for all observations beginning in March 1949 (the Philadelphia–Baltimore merger date), the Midwest dummy takes the value one beginning in December 1949 (the Midwest merger date). In Table VI the Pacific dummy takes the value one beginning in January 1957, the date of the Pacific merger. The coefficients of the dummy variables in each exchange equation then capture whether there was a change in market share of that exchange after the relevant merger.

Table V reports the results on the effects of the Philadelphia–Baltimore and Midwest mergers. As shown by the coefficients of the Philadelphia–Baltimore dummy, that merger had a positive and significant effect on the newly created exchange. The coefficient of the dummy variable indicates an increase in market share of 0.103 points, which constitutes a 12 percent increase over the combined average monthly market shares of the merging exchanges in the year preceding the merger. The Philadelphia–Baltimore merger also had a statistically significant negative effect on the Pittsburgh Stock Exchange, which had close geographic proximity to the merging exchanges and would eventually be absorbed into the Philadelphia Exchange.

The Midwest merger also had a positive and significant effect on the exchanges involved in that merger. The coefficient of the Midwest dummy indicates a 0.227 increase in the Midwest's market share, an increase of approximately 13 percent over the year preceding the merger. The Midwest merger is also associated with a significant decline in the market share of the Boston, Cincinnati, Pacific, and Philadelphia-Baltimore exchanges. Dur-

[12] The combined market shares of all the exchanges in the analysis is approximately 99 percent of the total volume of all exchanges. The regressions cannot be estimated if all exchanges are included and the market shares sum to one.

[13] Actually, the analysis employs slightly less than four years following the Midwest merger to preclude interaction with the merger between the Philadelphia and Washington exchanges. The results are not sensitive to the length of the window studied.

Table V

Regression Analysis: Philadelphia–Baltimore and Midwest Mergers

This table reports regression analysis of the effect of the Philadelphia–Baltimore and Midwest exchange mergers on market share. The analysis uses monthly data for the March 1945 to October 1953 period and entails a system of equations in which the dependent variable in each equation is the dollar market share of the particular stock exchange. (In the premerger period, the dependent variable in the Midwest and Philadelphia–Baltimore equations is the summed market share of the subsequently merging exchanges.) The explanatory variables are a linear time trend and two dummy variables: the Philadelphia-Baltimore dummy takes a value of one beginning in March 1949 (the date of the Philadelphia–Baltimore merger) and zero before, the Midwest dummy takes a value of one beginning in December 1949 (the date of the Midwest merger) and zero before. Coefficients for the time variable are multiplied by 10^3. Cross-equation restrictions are imposed on the merger dummies so that the market share effects of any merger sum to one. Equations are corrected for first-order autocorrelation using generalized least squares. Data are from SEC reports. (*t*-statistics are in parentheses.)

Exchange	Philadelphia-Baltimore Dummy	Midwest Dummy	Constant	Time
AMEX	0.446	−0.077	10.44[a]	−0.455[a]
	(0.76)	(−0.13)	(20.0)	(−3.44)
Boston	−0.0021	−0.371[a]	1.264[a]	0.003[c]
	(−0.27)	(−4.95)	(22.40)	(1.76)
Cincinnati	0.004	−0.024[b]	0.673[a]	0.001[a]
	(0.46)	(−2.52)	(11.08)	(4.64)
Detroit	0.017	−0.021	0.309[a]	0.001[b]
	(0.62)	(−0.74)	(15.65)	(2.45)
Midwest	−0.075	0.227[c]	1.72[a]	0.008[a]
	(−0.63)	(1.92)	(18.25)	(3.30)
New Orleans	−0.002	0.001	0.155[a]	−0.000
	(−0.56)	(0.19)	(5.94)	(−0.00)
NYSE	−0.380	0.846	83.4[a]	−0.018
	(−0.55)	(1.31)	(160.1)	(−1.24)
Philadelphia-Baltimore	0.103[b]	−0.148[a]	0.779[a]	0.003[a]
	(2.27)	(−3.29)	(24.6)	(2.96)
Pittsburgh	−0.039[a]	−0.007	0.129[a]	0.001[b]
	(−3.13)	(−0.54)	(13.3)	(2.30)
Washington	0.005	−0.018[b]	0.013[b]	0.001[b]
	(0.61)	(−2.19)	(2.21)	(2.14)
Pacific	−0.058	−0.460[a]	1.89[a]	0.010[a]
	(−0.51)	(−4.05)	(23.1)	(4.41)

[a,b,c] Statistical significance at the 1, 5, and 10 percent levels, respectively.

ing this time there was no significant effect on the NYSE or AMEX. Hence, both of the mergers examined in Table V appear to have attracted their market share from other regional exchanges rather than from the New York exchanges. Note that actual volume was growing on the merging and nonmerging exchanges at this time.

Table VI contains analogous regression analysis of the Pacific merger. Though the coefficient of the Pacific dummy has a positive sign, it is not more than two standard errors from zero. We find no evidence that the

Table VI

Regression Analysis: Pacific Merger

This table reports regression analysis of the effect of the Pacific Exchange merger on market share. The analysis uses monthly data for the December 1953 to January 1961 period and entails a system of equations in which the dependent variable in each equation is the dollar market share of the particular stock exchange. (In the premerger period, the dependent variable in the Pacific equation is the summed market share of the Los Angeles and San Francisco exchanges.) The explanatory variables are a linear time trend and a dummy variable; the Pacific dummy takes a value of one beginning in January 1957 (the date of the Pacific merger) and zero earlier. Coefficients for the time variable are multiplied by 10^3. Cross-equation restrictions are imposed on the merger dummy so that the market share effects of the merger sum to one. Equations are corrected for first-order autocorrelation using generalized least squares. Data are from SEC reports. (*t*-statistics are in parentheses.)

Exchange	Pacific Dummy	Constant	Time
AMEX	−0.248	6.467[a]	0.032[b]
	(−0.40)	(13.1)	(2.33)
Boston	0.066[b]	0.929[a]	−0.005[a]
	(2.26)	(49.0)	(−8.06)
Cincinnati	0.005	0.095[a]	−0.001[a]
	(0.75)	(22.1)	(−2.59)
Detroit	0.028	0.432[a]	−0.001[a]
	(1.62)	(39.3)	(−4.01)
Midwest	0.028	2.51[a]	0.003[b]
	(0.42)	(50.7)	(2.09)
NYSE	−0.081	86.5[a]	−0.027[c]
	(−0.13)	(188.9)	(−1.97)
Philadelphia-Baltimore-Washington	−0.071	0.937[a]	−0.000
	(−1.64)	(34.1)	(−0.00)
Pittsburgh	0.019[a]	0.159[a]	−0.001[a]
	(2.58)	(33.6)	(−9.19)
Pacific	0.119	2.05[a]	−0.002
	(1.62)	(48.6)	(−1.58)

[a,b,c] Statistical significance at the 1, 5, and 10 percent levels, respectively.

Pacific merger had a negative effect on any other exchange, although surprisingly the coefficients of the Pacific merger dummy are positive and significant for the Boston and Pittsburgh exchanges. It may be that the Pacific Exchange, being in a later time zone, had limited competition with the other exchanges.

The regression results reported in Table VI also provide some simple, long-run evidence on the success of the Midwest and Philadelphia-Baltimore exchanges in attracting market share, at least in relation to other regionals not involved in mergers. Note that the time-trend variable captures the effects of time trends from 1953 to 1961. The coefficient of this variable is positive and significant for the Midwest Exchange, and positive but insignificant for the Philadelphia Exchange. In contrast, the time-trend variable has a negative and significant coefficient for the nonmerging exchanges of

Table VII

Change in Bid-Ask Spreads around Regional Exchange Mergers

This table reports the change in dollar bid-ask spreads for three regional stock exchange mergers. The dollar spread is given for the month before the merger and for the month after the merger. Percentage change is the change in the spread from the month before to the month after the merger. Data are reported separately for securities traded only on the regional exchange (Regional), as well as securities also traded on the NYSE and NY Curb. Data are from the *Bank & Quotation Record*. (See the Appendix for further discussion of the estimation of bid-ask spreads around exchange mergers.)

Merger	*N*	Before	After	Percentage Change
Midwest (December 1949)				
Regional	58	1.162	1.106	−5%
NYSE	32	0.406	0.383	−6%
NY Curb	9	1.222	1.236	+1%
Pacific (January 1957)				
Regional	30	1.088	0.677	−38%
NYSE	0	–	–	–
NY Curb	0	–	–	–
Philadelphia-Baltimore (March 1949)				
Regional	6	3.854	3.625	−6%
NYSE	3	0.292	0.417	+43%
NY Curb	1	0.250	0.125	−50%

Boston, Cincinnati, Detroit (and of Pittsburgh, which later merged with Philadelphia), suggesting relatively poor performance by the nonmerging exchanges in response to changing market conditions.

C. Mergers and Bid-Ask Spreads

To complement the analysis of trading volume and market share, we analyze bid-ask spreads. Table VII reports the change in spreads from the month before to the month following the three mergers. For each merger, the data are segregated based on whether the underlying security is traded solely on the regional exchange or also in New York. As noted in the Appendix, the analysis is restricted to securities with available data on spreads both before and after the merger, which may lead to a bias in the results because the stocks with available data tend to be thinly traded stocks. The type of stock that is thinly traded may not be representative of stocks in general, furthermore the type of firm (and thus bid-ask spread) that is thinly traded may change after the merger, making comparisons around the merger difficult.

For the Midwest merger, the bid-ask spreads of the 58 regional-only securities narrow on average by five percent. The 32 NYSE-listed securities on the Midwest Exchange experience a similar average decline following the merger. By contrast, the spreads of the nine NY Curb securities widen

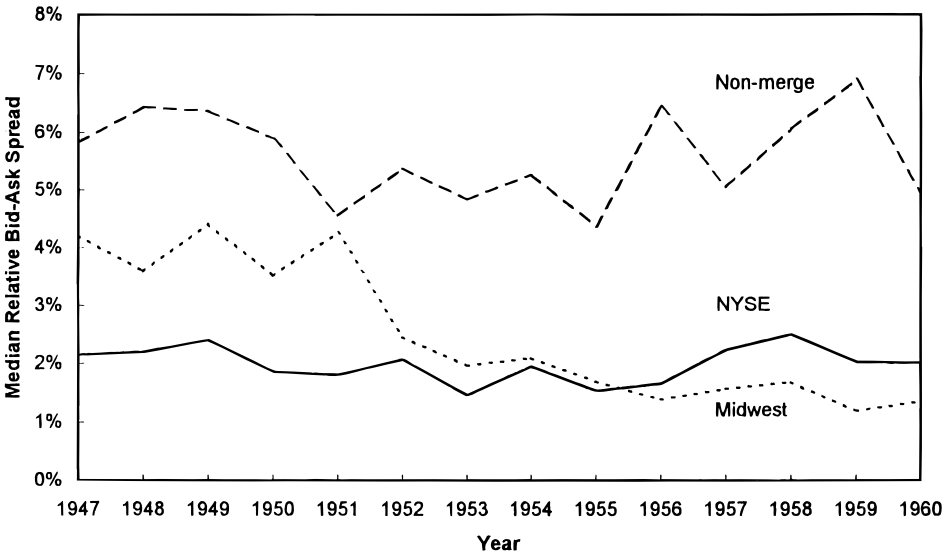

Figure 4. Bid-ask spreads on the Midwest Stock Exchange and two control samples, 1947–1960. This figure plots the median bid-ask spread of the Midwest Stock Exchange and two control samples: the New York Stock Exchange (NYSE) and a composite of two nonmerging exchanges (Boston and Detroit). Estimates of bid-ask spreads in a given year are for the last trading day in January. Data are from the *Bank & Quotation Record*.

slightly.[14] The bid-ask spreads of regional-only listings on the Pacific and Philadelphia-Baltimore exchanges also experience a narrowing of bid-ask spreads following the two mergers. For these two mergers, the available data are insufficient to assess the effect on the spreads of firms listed in New York.

For a longer-term analysis of the change in bid-ask spreads, we estimate the width of the spread on the Midwest Stock Exchange and several control samples for the period from 1947 to 1960. As noted in the Appendix, this time-series analysis includes any security with a bid-ask spread available in any given month. Figure 4 shows that the Midwest Stock Exchange experienced a noticeable narrowing of its median relative bid-ask spread following its formation via merger in December 1949. By contrast, the two control samples, the NYSE and two nonmerging regional exchanges for which we have data (Boston and Detroit), show no marked reduction in median bid-ask spreads. The net reduction in bid-ask spreads on the Midwest Exchange suggests one reason that the Midwest was successful in attracting order flow, which increased volume, which further reduced spreads, and so on.

[14] We find but do not report slight evidence of increasing spreads on the nonmerging exchanges at the time of the Midwest merger, the most successful merger. Thus, we do not attribute our evidence of spread declines as being due to overall market factors.

D. Mergers and Seat Prices

As a final assessment of the effects of the regional stock exchange mergers, we analyze the seat prices of the merging exchanges in the periods surrounding the mergers. This analysis examines whether the prospective and future members of the regional exchanges anticipated any gains at the time of the mergers. A problem with this analysis is that the seats on the regional exchanges are not as actively traded as are the seats on the NYSE, which have been studied by Schwert (1977a, 1977b). To capture the effect of the mergers without adding noise to the analysis, we measure the change in the total seat price value (the product of the number of seats times the price of a seat) of the merging exchanges from three months prior to the merger announcement to three months after the actual merger. We compute similar estimates for three control samples: other nonmerging exchanges, the NYSE, and the NY Curb.

Note also that although we often report large percentage changes in seat prices, the percentages may not be very informative. This is because the seat prices are low. For example, in the discussion below we note that over a three-month period the Boston seat prices fell 13 percent. This is a decline in price from $2000 to $1750 for a regional with 122 seats. Most of the other regionals' seat prices were not even that high. In contrast, at that time NYSE seats sold for approximately $40,000.

The results of the seat price analysis are reported in Table VIII. The total seat price value of the Midwest Exchange increases by four percent in the period surrounding the merger. Meanwhile, the three control groups suffer declines in their seat price value. The seat price value of the Pacific Exchange also increases around the time of its merger; the seat price of the nonmerger control group appreciates by a similar magnitude over the same time interval, but the values for the NYSE and AMEX decline. The seat price value of the Philadelphia-Baltimore Exchange declines surrounding that merger, as do all three control groups. In sum, the greatest net appreciation in seat prices occurs on the Midwest Exchange, arguably the most successful merger.

A closer look at the seat price movements on the Midwest merger, the merger for which there is the most timing information, reveals results consistent with our regression analysis. The regression analysis suggests that the exchanges most harmed by the Midwest merger were the Pacific, Philadelphia-Baltimore, and the Boston exchanges (Cincinnati and Washington also appear to have been harmed but we have very limited useful seat price data for those exchanges). Boston and Philadelphia-Baltimore also suffered large seat-price declines in the period surrounding the announcement and execution of the Midwest merger (a greater than 62 percent decline on the Philadelphia-Baltimore Exchange, the largest seat-price decline of any exchange, and a 58 percent decline on the Boston Exchange). In the short three-month window around the date that it became clear the Midwest merger would occur (May 1949), Philadelphia-Baltimore seat prices fell 54 percent and Boston prices fell 13 percent (Detroit's seat prices fell 30 percent in the short window).

Table VIII

Change in Seat Price Value around Regional Exchange Mergers

This table reports the percentage change in the total value of stock exchange seats for three regional stock exchange mergers. Percentage change is the change in the total value of stock exchange seats on the merging exchange measured from 3 months prior to the announcement of the merger to 3 months following the merger, where the beginning value is the sum of the seat values of all merging exchanges and the ending value is the value of all the seats of the newly created exchange. The percentage change in seat price value for the control groups is computed in the same fashion. Nonmerge is computed from a composite of the seat price values of the Boston and Detroit stock exchanges. All seat price data are from the *Bank & Quotation Record*.

Exchange	Announcement Month	Merger Month	Percentage Change
Midwest	August 1948	December 1949	3.99%
Control Groups:			
Nonmerge			−64.87%
NYSE			−26.47%
NY Curb			−56.52%
Pacific	July 1956	January 1957	14.44%
Control Groups:			
Nonmerge			21.98%
NYSE			−21.82%
AMEX			−16.67%
Philadelphia-Baltimore	November 1948	March 1949	−60.91%
Control Groups:			
Nonmerge			−42.89%
NYSE			−41.67%
NY Curb			−67.39%

In contrast, though other exchanges (where we find no market share decline in the regressions) suffered seat price declines over the period of the announcement and execution of the merger, the decline mainly occurred at the time of the announcement. Some of the other exchanges actually had seat price increases after the consummation of the Midwest merger. For example, from the month of the merger to the month after, NYSE seat prices rose almost 13 percent and NY Curb seat prices rose more than 26 percent. It may be that at the time the merger was announced it was anticipated the merger would have wide-ranging effects, but in actuality the main competitive impact was on the Pacific, Philadelphia-Baltimore, and Boston exchanges.

E. Summary of the Empirical Evidence

The empirical evidence reported in this section indicates that the mergers of regional stock exchanges were successful in that they increased the ability of the merging exchanges to compete for order flow, especially in NYSE-listed stocks. In the short run, dollar volume on the merging exchanges increased relative to the volume on exchanges not involved in mergers. Over

time, the merging exchanges increased their market share, with the added trading coming at the expense of other, nonmerging exchanges. Hence, the mergers consolidated order flow. Consistent with these results, the bid-ask spreads of the merging exchanges narrowed. Another explanation of the result is that the mergers created more effective competitors, which may also account for the narrower spreads. Note that there is no evidence the mergers had effects on the New York exchanges. There were no changes in NYSE volume or spreads. The regionals appeared to compete on NYSE-listed stocks mainly with other regionals.

The question of whether mergers improve productivity or, instead, enhance collusion has been addressed by other researchers, including Eckbo (1983) and Healy, Palepu, and Ruback (1992). Our results contribute to this inquiry. The increased market share indicates that, at least in our study, mergers do improve performance. Moreover, the narrowing spreads on the merging exchanges, together with the lack of any increase on other, nonmerging exchanges, suggest that the mergers increased competition to the benefit of securities investors.

III. Conclusion

This paper analyzes the causes and effects of the competition for order flow by regional stock exchanges. We trace the origins of competition for order flow to the regional exchanges' change of emphasis from local issues to securities listed on the New York exchanges. We then study a series of mergers that occurred in the midst of this transition of the regional exchanges and find that the merging exchanges attracted market share and experienced narrower bid-ask spreads.

Interpretation of the results in light of the ongoing debate of the efficiency effects of fragmentation is more difficult. One plausible interpretation of the empirical evidence is that the merging exchanges were successful because they were better able to reduce order fragmentation and achieve economies of scale. This competitive explanation of the mergers is consistent with the prediction made by the president of the Philadelphia-Baltimore Stock Exchange at the inception of that newly merged market: "There will be large economies in having a single floor of operations. . . . [T]he merger . . . eliminates bids and offers originating from two points."[15]

An alternative explanation is that the mergers increased the ability of the merging exchanges to compete with the NYSE. This interpretation, based on the increased competition that can arise through fragmentation, suggests the mergers enabled the regional exchanges to become more effective competitors for the NYSE.[16]

[15] *New York Times* (1949a, p. 25).

[16] As contrasting examples of the effects of fragmentation see McInish and Wood (1995), who find that increasing fragmentation (competition) results in tighter spreads for NYSE stocks, and Easley, Kiefer, and O'Hara (1996), who find fragmentation leads to cream-skimming.

Regardless of the interpretation of the cause of the results we report, we suggest the outcomes of midcentury regional stock exchange mergers in the United States still have pertinent policy implications for current-day financial markets. Ongoing improvements in communications technology, together with political and regulatory changes such as the formation of the European Union and the worldwide privatization movement, have led to mergers and proposals for the merging of equity and futures markets in the United States and abroad, including the pending merger of Nasdaq and AMEX, the proposed mergers of the Philadelphia Exchange with AMEX-Nasdaq, the Chicago Stock Exchange with Instinet, and the Boston Stock Exchange and the Cincinnati Stock Exchange with anyone. For example, most analyses of the AMEX-Nasdaq merger cite the gains AMEX would receive from access to Nasdaq's technology. Our results suggest that the current merger proposals should be interpreted as a natural competitive response to the changing environment faced by financial exchanges.

Appendix

The data used in this study come from a number of sources, including monthly and annual reports of the U.S. Securities and Exchange Commission, the *Bank and Quotation Record*, *Moody's Industrial Manual,* and various financial media such as *Business Week*, *Barron's*, the *Wall Street Journal*, the *New York Times*, and newspapers from the home cities of the regional stock exchanges. Most of the data used in the study, such as the figures on trading volume and market share tabulated by the U.S. SEC, are implemented in a straightforward fashion.

The *Bank and Quotation Record* is the source of several aspects of data, including the composition of trading volume, seat prices, and bid-ask spreads. This publication has been issued monthly since 1928, when it began providing information for the New York Stock Exchange, the New York Curb, and nine regional stock exchanges: Baltimore, Boston, Chicago, Cleveland, Detroit, Los Angeles, Philadelphia, Pittsburgh, and San Francisco.

The tabulation of bid-ask data in the *Bank and Quotation Record* merits particular discussion. For a given month, the publication reports prices for the first and last trading days. When a transaction does not take place on a particular trading day, a bid-ask quote is instead reported. In some cases, data are missing for a particular security on a particular date. As an example, consider the following entries in the *Bank and Quotation Record* for the Baltimore Stock Exchange for January 31, 1929:

Firm	Bid	Ask	Interpretation
Annapolis Dairy Prod	13 3/4	17	Bid-ask quote
Arundel Corporation	42 1/2	Sale	Transaction price
Baltimore Brick	–	–	Missing data

Table AI

Median Bid-Ask Spreads

This table reports the median relative bid-ask spread (percentage) for the Midwest Stock Exchange and three control samples: pooled data from the Boston and Detroit stock exchanges (Nonmerge), the New York Stock Exchange (NYSE), and the New York Curb Exchange (NY Curb). Data are from the *Bank & Quotation Record*. For each cell, estimates are sampled on the last trading day in January; estimates exclude observations with either a trade on that date or with missing data on that date. (See Table AIII for the number and fraction of observations with available data for a given exchange in a given year.) In the three years prior to its merger (1947, 1948, and 1949), Midwest pools data from the Chicago and Cleveland exchanges.

Date	Midwest	Nonmerge	NYSE	NY Curb
January 1947	4.21	5.83	2.15	5.00
January 1948	3.59	6.45	2.20	5.02
January 1949	4.41	6.37	2.40	5.13
January 1950	3.51	5.89	1.86	4.51
January 1951	4.26	4.55	1.81	4.08
January 1952	2.45	5.38	2.07	4.11
January 1953	1.96	4.83	1.46	3.33
January 1954	2.09	5.27	1.95	4.26
January 1955	1.69	4.36	1.54	3.76
January 1956	1.39	6.45	1.66	3.31
January 1957	1.57	5.05	2.23	3.92
January 1958	1.68	6.06	2.50	4.88
January 1959	1.19	6.90	2.03	3.67
January 1960	1.36	4.94	2.01	3.92

Due to the reporting convention of the *Bank and Quotation Record*, the estimation of bid-ask spreads is drawn from securities without a trade on a particular date.

Because of the nature of the data, we follow two procedures in estimating bid-ask spreads. For short-run analysis of changes in bid-ask spreads around mergers (refer to Table VII), we use a matched-firm approach. In other words, we compare spreads for firms with data on spreads for *both* the date before and the date after the merger.

For long-term analysis of bid-ask spreads following mergers (see Figure 4), the matched-firm approach is much less feasible. The likelihood that a firm would have bid-ask spread data for, say, 10 years in a row is rather remote; a firm that survived for 10 years might not have had a transaction on the sampled trading days. Hence, for the long-term analysis we average the bid-ask spread for a given exchange for all firms with available spread data for a given date. The date we choose, somewhat arbitrarily, to estimate spreads is the final trading date in January for each year.

Tables AI, AII, and AIII show the results of this procedure in the context of the Midwest Stock Exchange and three control samples: a composite measure of nonmerging regional exchanges (which pools the Boston and Detroit exchanges), the New York Stock Exchange, and the New York Curb. Tables AI and AII report median and mean relative spreads, respectively.

Table AII

Mean Bid-Ask Spreads

This table reports the mean relative bid-ask spread (percentages) for the Midwest Stock Exchange and three control samples: pooled data from the Boston and Detroit Stock Exchanges (Nonmerge), the New York Stock Exchange (NYSE), and the New York Curb Exchange (NY Curb). Data are from the *Bank & Quotation Record*. For each cell, estimates are sampled on the last trading day in January; estimates exclude observations with either a trade on that date or with missing data. (See Table AIII for the number and fraction of observations with available data for a given exchange.) In the three years prior to its merger (1947, 1948 and 1949), Midwest pools data from the Chicago and Cleveland exchanges. (Standard deviation percentages are reported in parentheses.)

Date	Midwest	Nonmerge	NYSE	NY Curb
January 1947	6.55	12.49	3.36	6.34
	(7.17)	(17.48)	(4.25)	(5.89)
January 1948	5.22	10.30	2.94	6.98
	(6.25)	(12.33)	(2.57)	(7.09)
January 1949	6.76	11.74	3.20	7.34
	(6.76)	(15.70)	(3.07)	(7.18)
January 1950	6.12	9.69	2.67	6.76
	(11.18)	(13.19)	(3.46)	(9.53)
January 1951	6.17	8.66	2.60	6.15
	(5.99)	(12.88)	(3.13)	(8.95)
January 1952	3.77	9.03	2.65	5.87
	(4.25)	(11.93)	(2.26)	(7.85)
January 1953	3.52	7.03	2.06	4.95
	(4.18)	(6.89)	(1.96)	(6.00)
January 1954	3.86	10.42	2.72	5.57
	(4.60)	(13.51)	(2.78)	(5.54)
January 1955	3.45	8.96	2.43	5.04
	(5.23)	(10.81)	(2.52)	(5.99)
January 1956	2.98	10.06	2.58	4.67
	(4.27)	(12.59)	(4.69)	(6.15)
January 1957	2.93	8.21	3.09	5.13
	(4.02)	(9.61)	(3.54)	(4.94)
January 1958	3.89	12.38	3.35	6.75
	(6.30)	(13.95)	(3.46)	(7.34)
January 1959	3.98	10.92	2.84	4.87
	(8.48)	(11.23)	(2.71)	(5.33)
January 1960	3.05	11.42	2.74	5.07
	(8.48)	(11.23)	(2.71)	(5.33)

Note that median spreads are consistently narrower than the means, due to truncation at zero and to the presence of some abnormally wide spreads for a few securities.

Table AIII reports the number and fraction of observations available in the estimation of bid-ask spreads for a given exchange at a particular date. One noticeable regularity in this table is that the fraction of firms included in the bid-ask spread calculation declines over time for all exchanges. This is consistent with an increasing amount of trading volume over time, which implies that the average security is more likely to record a transaction on a given date.

Table AIII

Number of Observations for Bid-Ask Spread Data

This table reports the number of observations of bid-ask spread data available for the estimates in Tables AI and AII Data in each year are for the last trading day in January; data exclude observations with either a trade on that date or with missing data on that date. Values in parentheses are the fraction of the full sample with available bid-ask spread data.

Date	Midwest	Non-Merge	NYSE	NY Curb
January 1947	141	76	341	378
	(57%)	(29%)	(25%)	(45%)
January 1948	185	127	723	571
	(77%)	(44%)	(52%)	(70%)
January 1949	147	107	521	490
	(63%)	(38%)	(37%)	(61%)
January 1950	139	104	336	357
	(49%)	(37%)	(23%)	(47%)
January 1951	87	81	291	267
	(27%)	(27%)	(20%)	(35%)
January 1952	160	92	348	336
	(47%)	(33%)	(23%)	(43%)
January 1953	159	78	360	327
	(45%)	(24%)	(24%)	(42%)
January 1954	184	84	360	357
	(53%)	(30%)	(23%)	(45%)
January 1955	158	58	277	234
	(46%)	(21%)	(18%)	(29%)
January 1956	170	72	339	332
	(49%)	(26%)	(22%)	(40%)
January 1957	177	68	384	365
	(50%)	(24%)	(25%)	(43%)
January 1958	197	71	391	364
	(51%)	(26%)	(26%)	(43%)
January 1959	150	67	269	212
	(39%)	(25%)	(18%)	(24%)
January 1960	145	62	278	256
	(38%)	(23%)	(18%)	(29%)

Across exchanges, the data in Table AIII indicate an unequal fraction of securities with data available for the estimation of bid-ask spreads. For example, in January 1960 the sample for the Midwest Stock Exchange represents 38 percent of all securities on that exchange, the sample for the NYSE represents only 18 percent of its securities. The lower representation for the NYSE suggests that the estimate for that exchange is comprised of the relatively less liquid securities traded on the NYSE. Indeed, the mean spread of 2.74 percent reported in Table AII for the NYSE securities that did not trade on the last trading day of January 1960 compares to a mean spread of 1.66 percent reported by Stoll and Whaley (1983, Table 5) for all NYSE securities in 1960.

REFERENCES

Ahn, Hee-Joon, Charles Q. Cao, and Hyuk Choe, 1998, Decimalization and competition among stock markets: Evidence from the Toronto Stock Exchange cross-listed securities, *Journal of Financial Markets* 1, 51–87.

Barrons, June 27, 1955, Regional exchanges (Dow Jones, New York, N.Y.).

Battalio, Robert, Jason Greene, and Robert Jennings, 1997, Do competing specialists and preferencing dealers affect market quality? An empirical analysis, *Review of Financial Studies* 10, 969–993.

Battalio, Robert, Jason Greene, and Robert Jennings, 1998, Order flow distribution, bid-ask spreads, and liquidity costs: Merrill Lynch's decision to cease routinely routing orders to regional stock exchange, Working paper, Georgia State University.

Blume, Marshall E., and Michael A. Goldstein, 1997, Quotes, order flow, and price discovery, *Journal of Finance* 52, 221–244.

Business Week, May 16, 1936, Small stock exchanges weaker (McGraw Hill, New York, N.Y.) .

Chowdry, Bhagwan, and Vikram Nanda, 1991, Multimarket trading and market liquidity, *Review of Financial Securities* 4, 483–511.

Cole, Charles A, 1944, The regional exchanges before 1934, Mimeo., U.S. Securities and Exchange Commission, Washington D.C..

de Jong, Frank, Theo Nijman, and Ailsa Roell, 1995, A comparison of the cost of trading French shares on the Paris Bourse and on SEAQ International, *European Economic Review* 39, 1277–1301.

Demsetz, Harold, 1968, The cost of transacting, *Quarterly Journal of Economics* 82, 33–53.

Dilts, Marion May, 1941, *The Telephone in a Changing World* (Longmans, Green, & Co., New York, N.Y.).

Doede, Robert William, 1967, The monopoly power of the New York Stock Exchange, Unpublished Ph.D. dissertation, University of Chicago.

Easley, David, Nicholas M. Kiefer, and Maureen O'Hara, 1996, Cream-skimming or profit-sharing? The curious case of purchased order flow, *Journal of Finance* 51, 811–833.

Eckbo, B. Espen, 1983, Horizontal mergers, collusion and stockholder wealth, *Journal of Financial Economics* 11, 241–273.

Garvy, George, 1944, Rivals and interlopers in the history of the New York security market, *Journal of Political Economy* 52, 128–143.

Gordon, Roger H., and A. Lars Bovenberg, 1996, Why is capital so immobile internationally? Possible explanations and implications for capital income taxation, *American Economic Review* 86, 1057–1075.

Greenwood, W. J., 1921, *American Stock Exchange Practice, Stock and Bond Trading and the Business Corporation Laws of All Nations* (New York Financial Book Co., New York, N.Y.).

Healy, Paul M., Krishna G. Palepu, and Richard S. Ruback, 1992, Does corporate performance improve after mergers?, *Journal of Financial Economics* 31, 135–175.

Jarrell, Gregg A., 1984, Change at the exchange: The causes and effects of deregulation, *Journal of Law & Economics* 27, 273–312.

Kamm, Jacob O., 1942, *The Decentralization of Securities Exchanges* (Meador Publishing Co., Boston, Mass.).

Kang, Jun-Koo, and René M. Stulz, 1997, Why is there a home bias?: An analysis of foreign portfolio equity ownership in Japan, *Journal of Financial Economics* 46, 3–28.

Lee, Charles, 1993, Market integration and price execution for NYSE listed securities, *Journal of Finance* 48, 1009–1038.

McInish, Thomas H., and Robert A. Wood, 1995, Competition, fragmentation, and market quality; in Andrew Lo, ed.: *Industrial Organization and Regulation of the Securities Industry* (The University of Chicago Press, Chicago, Ill.).

Merrill, Francis Ellsworth, 1937, The Chicago Stock Exchange, Unpublished Ph.D. dissertation, University of Chicago.

New York Times, March 11, 1926, Ticker to coast starts Monday (New York Times Publishing, New York, N.Y.).

New York Times, August 21, 1930, Chicago ticker to reach coast (New York Times Publishing, New York, N.Y.).

New York Times, February 1, 1929, Long distance rate will be cut today (New York Times Publishing, New York, N.Y.).

New York Times, November 19, 1948, 2 exchanges study plans for a merger (New York Times Publishing, New York, N.Y.).

New York Times, March 7, 1949a, Merged exchanges to operate today (New York Times Publishing, New York, N.Y.).

New York Times, December 2, 1949b, Midwest exchange has a big first day (New York Times Publishing, New York, N.Y.).

New York Times, July 31, 1956, 2 West Coast stock exchanges seeking approval for a merger (New York Times Publishing, New York, N.Y.).

Pacific Exchange Stock Exchange, 1996, *Annual Report* (San Francisco, CA).

Page, Arthur W., 1941, *The Bell Telephone System* (Harper and Brothers, New York, N.Y.).

Schwert, G. William, 1977a, Public regulation of national securities exchanges: A test of the capture hypothesis, *Bell Journal of Economics* 8, 128–150.

Schwert, G. William, 1977b, Stock exchange seats as capital assets, *Journal of Financial Economics* 4, 51–78.

Securities and Exchange Commission, U.S., 1940, *Report to the Commission by the Trading and Exchange Division on the Problem of Multiple Trading on Securities Exchanges* (November 20, 1940) (U.S. Government Printing Office, Washington, D.C.).

Securities and Exchange Commission, U.S., 1941, *In the Matter of the Rules of the New York Stock Exchange* 10 SEC 270 (October 4, 1941)(U.S. Government Printing Office, Washington, D.C.).

Securities and Exchange Commission, U.S., 1944, *Tenth Annual Report* (U.S. Government Printing Office, Washington, D.C.).

Securities and Exchange Commission, U.S., 1949, *Fifteenth Annual Report* (U.S. Government Printing Office, Washington, D.C.).

Securities and Exchange Commission, U.S., 1952, *Eighteenth Annual Report* (U.S. Government Printing Office, Washington, D.C.).

Securities and Exchange Commission, U.S., 1963, *Special Study of the Securities Markets* (House Document No. 95, 88th Congress, 2d Session) (U.S. Government Printing Office, Washington, D.C.).

Securities and Exchange Commission, U.S., 1994, *Market 2000: An Examination of Current Equity Market Developments* (U.S. Government Printing Office, Washington, D.C.).

Simon, Carol J., 1989, The effect of the 1933 Securities Act on Investor Information and the performance of new issues, *American Economic Review* 79, 295–318.

Smith, Clifford W., 1991, Globalization of financial markets, *Carnegie-Rochester Conference Series on Public Policy* 34, 77–96.

Smith, Frank P., 1936, The future of small securities exchanges, *Harvard Business Review* 14, 360–369.

Stigler, George, 1958, The economies of scale, *Journal of Law and Economics* 1, 54–71.

Stigler, George, 1961, The economics of information, *Journal of Political Economy* 49, 213–225.

Stigler, George, 1964, Public regulation of the securities market, *Journal of Business* 37, 117–142.

Stoll, Hans R., and Robert E. Whaley, 1983, Transaction costs and the small firm effect, *Journal of Financial Economics* 12, 57–79.

Walter, James E. 1957, *The Role of Regional Security Exchanges,* (University of California Press, Berkeley, Calif.).

West, Richard R., and Seha M. Tinic, 1971, *The Economics of the Stock Market* (Praeger, New York, N.Y.)