Competing with the NYSE

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Abstract

The NYSE's recent merger with Archipelago and the proposed merger between the NYSE and Euronext raise many questions about the effects of competition between stock exchanges. We examine the largely forgotten, but unparalleled episode of competition between the New York Stock Exchange (NYSE) and the Consolidated Stock Exchange of New York (Consolidated) from 1885 to 1926. The ratio of Consolidated to NYSE volume averaged 40 percent and reached as high as 60 percent from 1885 to 1895. The Consolidated averaged 23 percent of NYSE volume for approximately 40 years by operating a second market for the most liquid securities that traded on the Big Board. Our results suggest that NYSE bid-ask spreads fell by more than 10 percent when the Consolidated began to trade NYSE stocks and subsequently increased when the Consolidated ceased operations. The Consolidated brought innovations to Wall Street including the establishment of a clearinghouse to increase the transparency of financial transactions and odd-lot trading. The stock market rivalry also played an important role in the development of the NY Curb Market (American Stock Exchange). The results suggest that (1) the NYSE has faced significant competition, (2) competition reduces bid-ask spreads, and (3) competition between exchanges may improve investor welfare by encouraging institutional innovations.

Keywords: NYSE, stock exchange competition, bid-ask spreads
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"The [New York] Stock Exchange is frightened. It may seem strange that an institution which has always assumed to be invulnerable should be frightened, but it is merely a big fool of the air at which the king bird is picking with such success as to threaten its life. The king bird is the Consolidated Stock Exchange." (*Washington Post*, July 24, 1887, p. 3)

Competing with the NYSE

For a significant part of its 215-year history, the New York Stock Exchange (NYSE) has reigned as the leading stock exchange of the world. Recently technological changes and globalization have given rise to a number of competitors that could threaten the NYSE's preeminent position. Technological change has played an important role in fostering the development of alternative trading systems (Macey and O'Hara, 1999) while globalization may have large and significant effects on financial markets (Ramos, 2003). Indeed, in the July 21, 2005, S-4 filing related to its proposed merger with Archipelago, a rival exchange, the NYSE identifies the growth of global capital markets and the emergence of electronic communications networks as a significant threat to its dominant market share (p. 141). The NYSE has responded to this challenge by merging with a leader in new technology (Archipelago) and proposing to merge with world's leading cross border exchange (Euronext).

These mergers raise many questions about the effects of stock market competition with the NYSE on bid-ask spreads, the industrial organization of financial exchanges, and the optimal number of exchanges in the marketplace. Unfortunately, prior empirical evidence offers little insight into this important public policy question. Research focusing on past (e.g., Branch and Freed (1977), Hamilton (1976, 1979, 1987), Tinic (1972)) and more recent episodes (e.g., Barclay, Hendershott, and McCormick (2003), Battalio (1997), Battalio, Greene and Jennings (1997)) of direct trading competition with the NYSE has studied relatively minor magnitudes of off-exchange trading by regional exchanges and/or the third market. Much of this competition was limited in both scale and scope and often related to regulatory mandates by the Securities and Exchange Commission. (See Jarrell (1984) and Arnold, Hersch, Mulherin and Netter (1999).)

In this paper, we provide new evidence on both the viability and nature of direct trading competition with the NYSE. We study the largely forgotten Consolidated Stock Exchange, a rival stock exchange that competed directly with the "Big Board" from 1885 to 1926. For almost 42 years, the Consolidated was an important competitor and garnered an average annual market share reaching as high as 60 percent of NYSE trading volume. This sustained incidence of competition with the NYSE came at a time of significant technological change in securities trading and thereby has direct relevance to the current competitive forces confronting the NYSE today.

Although the Consolidated has been noted in historical research by Nelson (1907), Garvy (1944), and Sobel (1972) and in more recent analysis of the property rights to price quotations by Mulherin, Netter and Overdahl (1991), there is little or no systematic analysis of this exchange's impact on the NYSE. Indeed, in an otherwise insightful and comprehensive analysis, Doede (1967) discounts the importance of the rival exchange due to the absence of reported data on Consolidated trading volume (p. 27). We fill the historical and empirical void of this important episode of stock exchange competition with newly collected data from *The New York Times* and other sources.

Our analysis focuses on the effects of competition on NYSE bid-ask spreads and the institutional makeup/organization of the Big Board and Wall Street. We first study the impact of competition on bid-ask spreads when the Consolidated began to trade NYSE stocks in 1885. Then we analyze the effects of competition on bid-ask spreads for approximately 40 years of the stock exchange rivalry. Our results suggest that NYSE bid-ask spreads fell by more than 10 percent when the Consolidated began to trade NYSE stocks and subsequently increased when the "Little Board" ceased operations. The Consolidated brought several important innovations to Wall Street including a clearinghouse that increased the transparency of stock trading and odd-lot trading. The rivalry also played an important role in the development of the NY Curb Market (American Stock Exchange). In addition, the empirical analysis suggests that the Consolidated

may have improved the efficiency of stock prices by contributing to the price discovery process. Although our analysis does not provide a public policy prescription for the optimal number of financial exchanges in the market place, the results suggest that a significant competitor such as the Consolidated can reduce bid-ask spreads and produce important institutional innovations that improve the efficiency of financial markets for firms and investors.

The remainder of the paper proceeds as follows. Section 1 describes the trading environment on the NYSE in the years prior to the onset of competition by the Consolidated in 1885. Section 2 reports data on the magnitude and nature of the stock market competition provided by the rival exchange over the period 1885 to 1926. Section 3 analyzes the short and long-run effects of competition on NYSE bid-ask quotes and institutional innovation on Wall Street. Then we test whether the Consolidated contributed to the price discovery process. Section 4 summarizes the results and concludes the paper with a discussion of the implications of our findings for future studies of stock market competition.

1. The Trading Environment at the Onset of Competition

The Consolidated Stock Exchange was formed in early 1885 by the merger of the New York Mining Stock and Petroleum Exchange, the New York Petroleum Exchange and Stock Board and the Miscellaneous Securities Board. These exchanges initially specialized in mining and petroleum securities that were not traded on the NYSE. Soon after the merger, however, the Consolidated began trading railroad stocks and other securities listed on the NYSE. *The New York Times* reported that the Consolidated decided to trade NYSE listed securities in news articles dated January 21, 1885 and February 14, 1885. The newspapers began reporting Consolidated trading volume of NYSE listed securities February 17, 1885.[1]

[1] For background on the formation of the Consolidated Stock Exchange, see Nelson (1907), Garvy (1944), Sobel (1972), and Mulherin, Netter and Overdahl (1991). An appendix of relevant news stories is available from the authors.

The onset of competition from the Consolidated occurred during a period of rapid growth in the depth and the breadth of trading on the NYSE. As reported in Table 1, in the ten years prior to the formation of the Consolidated, trading volume steadily rose and was, on average, twice as high in the 1880-1884 period compared to the 1875-1879 period. The number of trading days exceeded more than 300 each year because the NYSE opened for an abbreviated session of business on Saturday until after World War II.

As reported in Table 2, the growth in volume was accompanied by an increase in listings on the NYSE, as proxied by the number of NYSE-listed firms reported daily in *The New York Times*. Historical records from the NYSE confirm that listings doubled on the exchange between 1875 and 1884. (See, e.g., the 1940 New York Stock Exchange Yearbook, p.49.) In addition, the median bid-ask spread increased across all NYSE stocks as the number of securities reported in *The New York Times* rose over time. However, the median spread for firms with reported trading volume remained at 0.25 for most of the period. Railroads or Western Union were the most active security for the sampled day in a given year. These securities always traded at the minimum tick of one-eighth.

Garvy (1944), Michie (1986), and Mulherin, Netter and Overdahl (1991) link the growth in the depth and breadth of NYSE trading activity to various technological innovations. The transatlantic cable was completed in 1866 and the stock ticker was invented in 1867. Telephones came to the exchange floor in 1878. Garbade and Silber (1978) report that financial markets readily adopted these new technologies. Field (1998) details how the telegraph and ticker revolutionized the flow of information and trading in securities markets. Accompanying organizational innovations such as the movement from call to continuous markets enhanced the available market for NYSE listings as well as the capacity for the exchange to trade. Sylla (1995) argues that many important elements of the modern financial markets were developed during the late nineteenth and early twentieth century.

The innovations that enhanced the potential of the NYSE also increased the probability of competition from existing and rival exchanges (e.g., Garvy (1944), Michie (1986), and Mulherin, Netter and Overdahl (1991)). The Consolidated's more than 2,000 members conducted trading on a floor in a building a few blocks from Wall Street at the corner of Broad and Beaver Streets. Because the NYSE, the New York Mining Stock and Petroleum Exchange and other predecessors had gentlemen's agreements not to engage in direct trading competition, the Consolidated at its inception possessed stock tickers linked to the NYSE and thereby had ready access to the information required to engage in the trading of NYSE listings.

The Consolidated attracted trading in NYSE listings by charging lower commissions, offering odd lot trading, and allowing a longer settlement period. The rival exchange even functioned as the primary New York market when it opened one-half hour before the NYSE for a period beginning in July 1912. Commission rates on the Consolidated averaged 1/16th of the par value of a stock or half the brokerage commission charged by the NYSE. However, the NYSE had several loopholes that allowed members to bypass its high brokerage fees. Members that bought and sold stock between each other were charged rates as low as 1/32nd of par value and deals between brokers on the floor of the exchange could go as low as 1/50th percent of a stock's par value. The discount on commissions was extended to all partners of an NYSE firm even if they did not own a seat on the exchange. The discount policy led to the creation of ever larger stockbroking firms (Michie, 1986). The Consolidated also dealt in odd lots, executing trades of only 10 shares as opposed to the NYSE that required an order size of at least 100 shares.[2] In addition, the Consolidated had a two-week settlement period (that was later changed to one-week) as opposed to the daily settlement period for the NYSE.

The New York Stock Exchange immediately responded to the Consolidated's decision to trade Big Board stocks. The NYSE implemented a series of measures in 1885 and 1886 to limit

[2] Ott (2004) shows that odd lot trading accounted for as much as 40 percent of the business of NYSE members by 1921. She also provides historical evidence that NYSE member firms often sold odd lots to retail customers at stale prices and that such trading was a highly profitable business for NYSE members.

the Consolidated's ability to gain market share. The NYSE passed a resolution mandating that 400 of its members drop their affiliation with the Consolidated (Mulherin, Netter, and Overdahl, 1991) and later amended this resolution to prohibit clerks in member firms from joining the Consolidated. In 1888, the New York Stock Exchange even suspended one of its members for conducting business with the rival exchange, although this measure did not eliminate trading between the two rivals as some brokers continued to conduct business and arbitrage price differences on the two exchanges. *The New York Times* often printed articles that discussed various aspects of competition between the two exchanges. In a February 27, 1891 article "A Wall Street Quarantine," the newspaper reported that the NYSE passed a resolution to limit competition from the Consolidated.

"After a lull, the old battle between the Stock Exchange and its youthful neighbor on the other side of New Street has broken out again... At the meeting of its Governors Tuesday a resolution was passed which was not made public until yesterday. It is a stringent order, and it reads in this way: Resolved, That all communications between this Exchange and the Consolidated Stock and Petroleum Exchange, or any part of the building thereof, by means of messengers or clerks, or in any other manner, directly or indirectly, is detrimental to the interests and welfare of this Exchange, and is hereby prohibited."

The NYSE also established an unlisted department that traded only "speculative" stocks listed on the Consolidated. Although this measure primarily covered mining and other less important securities, it signaled the NYSE's intention to limit competition from the rival exchange. The Big Board also vigorously challenged the Consolidated's use of its ticker. Mulherin, Netter and Overdahl (1991) detail this battle over property rights and the ticker. For our purposes, it is important to note the Consolidated maintained access to the ticker for the length of its history.

2. The Magnitude and Nature of the Stock Market Rivalry

The rivalry between the Consolidated and the NYSE lasted from 1885 to 1926. Table 3 provides estimates of the magnitude of the 42-year rivalry between the NYSE and the

Consolidated Stock Exchange from 1885-1926. We report the annual volume of common stock on the NYSE, the annual volume of NYSE-listed stocks on the Consolidated, and the ratio of Consolidated volume to NYSE volume. (See the Data Appendix for data sources.) The data show that the Consolidated quickly gained a significant share of the trading volume of NYSE-listed securities. In the first ten years of its existence, the ratio of Consolidated to NYSE volume averaged 40 percent. By 1894, the Consolidated traded as much as 60 percent of NYSE volume.[3] Over the course of the stock exchange rivalry, the Consolidated averaged 23.48 percent of NYSE volume. As late as 1921, the ratio of Consolidated to NYSE volume was 25.87 percent.

The rivalry ended in February 1926 with the demise of the Consolidated. Garvy (1944) and Sobel (1972) point to accusations of fraud and the prosecution of the Consolidated by the Attorney General of the State of New York under the auspices of the Martin Act of 1921.[4] William Silkworth, President of the Consolidated Stock Exchange in the early 1920s, allegedly misused a rescue fund in early 1922 for his own personal gain after asking member firms of the exchange to contribute to the fund. A few months later, one of the Consolidated's leading and most respected brokerage houses, Edward M. Fuller & Company declared bankruptcy. Silkworth was accused of embezzling funds from the brokerage house even though he denied any wrong-doing. Although Silkworth was subsequently exonerated of the charges, a Fuller executive pleaded guilty to fraud. The Consolidated continued to trade securities after the scandals and even introduced reforms to eliminate corruption on the exchange.[5] However, the historical evidence

[3] The data collected from *The New York Times* contain total volume for listed and unlisted securities but the NYSE only reports data for listed securities. As a result, our total volume data for the NYSE undercounts total volume for the period between 1888 and 1910 for the NYSE, when the NYSE closed its unlisted securities department. The total volume of unlisted securities is relatively small with the exception of American Sugar, which was a component of the Dow Industrial Average. We have NYSE volume data for American Sugar for the last day of the month from April 1894 until 1926. These data suggest that Table 3 may overstate the Consolidated's total volume relative to the NYSE by three percent to eight percent from 1893 to 1902 when American Sugar was among the most actively traded securities on both exchanges. This discrepancy does not affect our formal analyses which are conducted on individual securities where we have the actual data from both exchanges.

[4] The Martin Act was recently been used New York Attorney General Eliot Spitzer to indict Wall Street brokers and executives in the recent wave of corporate scandals.

[5] Ott (2004) shows that politics played an important role in the collapse of the Consolidated. She argues that the NYSE engaged in a public relations campaign from 1913 until 1929 and captured the New York

suggests that the reputation of the exchange had been irreparably damaged. News reports at the time indicate that attempts to revive the rival exchange ended with the revelation that the Consolidated did not possess the right to the tickers transmitting NYSE price quotes in early 1927. Doede (1967) also notes that the emergence of the New York Curb Exchange in the early twentieth century (later the American Stock Exchange), which adopted a more amicable and non-competitive relation with the NYSE, also led to a weakening of the Consolidated's position after 1909.

Table 4 presents some information on the nature of the 42-year stock market rivalry between the NYSE and the Consolidated. We collected trading data from a single day for each year between 1885 and 1926. Table 4 reports data on the number of NYSE firms listed, the number of NYSE firms with positive trading volume, and the number of NYSE-listed firms with trading volume on the Consolidated. (See the Data Appendix for specific dates and sources.) As reported in Table 4, the Consolidated tended to trade only a subset of NYSE listings on a given day. From 1885 to 1926, the Consolidated traded a median of 18 percent of NYSE listings. The median fraction of NYSE listings with volume that also traded on the Consolidated was 33 percent.

Table 5 provides evidence that the Consolidated tended to trade the relatively liquid NYSE listings. For a single day in each year between 1885 and 1926, the table reports the median bid-ask spread on the NYSE. While the median absolute (relative) bid-ask spread for all NYSE stocks with quotes averages $1.00 (2.08 percent) over the entire time period, the median absolute (relative) spread of the NYSE listings that also traded on the Consolidated averages $0.25 (0.53 percent). This is also lower than the average absolute (relative) spread of $0.75 (1.60 percent) for stocks with volume on the NYSE but not on the Consolidated. The tendency for a rival exchange

State Attorney General's Office which investigated the Consolidated for stock fraud and wash sales. Ott concludes that a public relations campaign by the NYSE was successful and that the Big Board managed to avoid significant federal and state regulation until the New Deal.

to trade relatively more liquid NYSE listings resembles the results found from studies of modern-day markets (e.g., Easley, Kiefer and O'Hara (1996), Battalio (1997)).

Table 6 provides additional evidence that the Consolidated tended to trade relatively liquid NYSE listings. For a single day in each of the sample years, the table reports the most heavily traded security on both the NYSE and the Consolidated. For 21 of the 42 years (50 percent of the time), the most heavily traded security on the NYSE was also the most heavily traded on the Consolidated. In only five of the 42 years was the most heavily traded security on the NYSE not in the top five in trading on the Consolidated. The most heavily traded security on both exchanges tended to trade at the minimum bid-ask spread of one-eighth, providing further evidence that the Consolidated emphasized relatively liquid NYSE listings.

The fact that the Consolidated, like many current-day NYSE competitors, tended to trade relatively more liquid securities poses some complications in identifying the effect of competition on the NYSE. As noted in the initial research on bid-ask spreads by Demsetz (1968, p. 45), measures of competition are likely to be associated with the rate of transactions across securities. Similarly, Tinic (1972, p. 88) notes that any measure of inter-exchange competition might also proxy for long-run trading activity. Such concerns were certainly present in the early analysis of NYSE bid-ask spreads and exchange competition that tended to be cross-sectional studies over a short time interval.

To estimate the effect of stock market competition initiated by the Consolidated, we perform a series of complementary tests. We begin with a natural experiment in which we study the effect of the onset of competition on NYSE bid-ask spreads. This experiment implicitly treats the onset of the Consolidated as an exogenous event. Boehmer and Boehmer (2003) have a similar research design in their recent study of the NYSE entry into the market of Exchange Traded Funds (ETFs). We then perform a panel study of the effect of the Consolidated on NYSE bid-ask spreads over the entire 42-year rivalry of the two exchanges. Such analysis resembles

Wahal's (1997) recent work on the effects of dealer competition on NASDAQ and avoids the critique of the early studies of the NYSE that focused on short periods of time.

3. Empirical Evidence

A. The Onset of Stock Market Competition

Our empirical analysis of stock market competition begins with the Consolidated's decision to trade NYSE stocks. This event provides a natural experiment to study the behavior of bid-ask spreads in the period before and after the rival exchange directly competed with the NYSE. To investigate this question, we estimate a series of regressions using NYSE bid ask-spreads as the dependent variable for a one-year period before and after the initiation of trading in NYSE listings by the Consolidated in February 1885. The regression analysis controls for firm-specific factors such as trading volume, price level, and return volatility that prior studies have found to affect bid-ask spreads (Demsetz 1968, Tinic 1972, Branch and Freed, 1977). The basic model can be written as:

$$SPREAD_{it} = \alpha_0 + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \varepsilon_{it}, \quad (1)$$

where $SPREAD_{it}$ is either the natural log of the absolute bid-ask spread or relative spread [(bid+ask)/(bid+ask/2)] for security i on day t. The volume and closing price variables, VOL_{it} and $CLOSE_{it}$, are measured as the natural log of the NYSE daily volume and closing price for security i on day t. Volatility, $STDEV_i$, is defined as the standard deviation of the natural log of security i's return over the entire sample period. To determine the effect of stock market competition, $COMP_t$ is a dummy variable that takes the value of one in the period beginning with the initiation of trading of NYSE listed stocks by the Consolidated on February 17, 1885. The white noise error term is given by ε_{it}. Bid-ask spreads for the empirical analysis are collected from *The New York Times*. The newspaper also reported trading volume, but not information on bid-ask spreads for

the Consolidated. Silber (2005) reports a similar non-reporting of data on NYSE competitors by major financial newspapers in his analysis of the closure of stock markets from the end of July to December 1914 following the outbreak of World War I.

The time period for the analysis is 60 weeks before and 60 weeks after the onset of Consolidated competition. This time interval is determined in part by data availability. As noted in the Data Appendix, our firm-level data on volume and bid-ask spreads come from *The New York Times*. The newspaper temporarily discontinued reporting NYSE bid-ask spreads in mid-April 1886. To have a continuous database, we use the interval from February 17, 1885, to April 9, 1886, for the Consolidated period. We use a comparable interval prior to the onset of off-exchange trading of NYSE listings as our pre-Consolidated time period.

We sampled data from Friday trading in each of the 60 weeks before and the 60 weeks after the onset of competition by the Consolidated. If Friday was not a trading day, we sampled from an adjacent day. For each day, we collected data on the closing price, volume, and bid-ask spreads of all NYSE common stocks reported in *The New York Times*. Our analysis focuses on NYSE-listed firms with non-zero trading volume, although our results are robust to including NYSE firms with zero trading volume on a given business day.[6] For the same time interval, we also collected control variables reflecting aggregate market conditions such as aggregate NYSE volume, the concentration of NYSE trading, and broker call rates.

The first panel in Table 7 provides summary statistics for the pre- and Consolidated periods. The sample contains 7,036 observations. This includes all companies with at least 12 observations of reported trading volume and bid-ask spreads on the NYSE. The mean absolute bid-ask spread and relative bid-ask spread are 0.685 and 2.78 percent respectively. The individual daily security volume ranges from five shares to 171,516 shares and averages 5,251 shares. The mean closing price is $52.89. The standard deviation of returns for the average security is 7.10

[6] The robustness checks are available from the authors upon request.

percent per week over the sample period. The number of observations that occur in the Consolidated period accounts for 53.4 percent of the total observations.

Table 7 also reports summary data on the control variables that we use in our robustness analysis. The mean aggregate weekly trading volume for all securities on the NYSE during the week is 1,990,360 shares. The mean share of total volume was 1.69 percent for securities with NYSE volume and the average concentration ratio for the four highest volume NYSE securities is 55.5 percent, indicating that NYSE volume was highly concentrated among the most active securities over the sample period. The concentration of trading in securities markets has been noted in modern day markets by Easley, Kiefer, O'Hara and Paperman (1996).

The second and third panels in Table 7 separately report the data for the pre- and Consolidated periods. The data suggest an average decline in both absolute and relative bid-ask spreads. For the remaining firm specific and market-wide variables, there does not appear to be a discernible trend or pattern in the data. For example, the average of individual NYSE security volume declines while the average NYSE stock price is relatively flat. The average of NYSE total weekly volume rises while the average broker call rate falls

Figure 1 graphs the average weekly bid-ask spread over the sample period for the NYSE and a group of the leading regional exchanges (Baltimore, Boston and Philadelphia).[7] The graph is suggestive in two important ways. First, the decline in bid-ask spread is not part of a larger trend of lower bid-ask spreads on the NYSE but is specific to the post-Consolidated period. Secondly, the lower bid-ask spread seems to be confined to the NYSE and not the regional exchanges. It is important to note that while the regional exchanges did trade some NYSE listed

[7] *The Commercial and Financial Chronicle* reported bid-ask spreads for some stocks on the regional exchanges that did not have trading volume for that particular day. For consistency, the average bid-ask spread for the NYSE is the average for all securities and includes some stocks that did not have any trading volume so the data in this figure are not directly comparable to those in later tables. For a couple of weeks when *The Commercial and Financial Chronicle* did not report bid-ask spreads for the regional markets, we interpolated the average bid-ask spread using the week before and after the missing observations. The Boston Exchange accounts for over 90 percent of the observations in Figure 1. For our formal analysis, we are forced to focus on the Boston Exchange due to the lack of sufficient observations with trading volume on the other regional exchanges.

securities at this time, the majority of stocks trading on these exchanges were not listed on the Big Board and did not face direct competition from the Consolidated.

In addition, we present summary statistics in Table 8 for securities with volume on the NYSE. The descriptive statistics are broken down into two groups: stocks traded by the Consolidated and securities not traded by the rival exchange. For the entire sample period, companies that the Consolidated traded accounted for 4,823 out of the 7,036 observations or 68.5 percent of the sample. However, the average volume of securities traded by the Consolidated was over 17 times higher than the NYSE listings that they did not trade. The companies that the Consolidated traded accounted for over 97 percent of the total trading volume over the full sample period. In addition to having lower volumes and lower bid-ask spreads in both the full period and the pre-Consolidated securities, the securities traded by the Consolidated tended to have lower average closing prices and higher volatility.

If we examine the change from the pre-Consolidated period to the Consolidated period for each group, then it is clear that the bid-ask spreads and relative bid-ask spreads fall for each group. The decline in spreads for the group with Consolidated trading is consistent with competition and the decline in the group without Consolidated trading is consistent with potential competition. On the other hand, the mean bid-ask spread for the regional exchanges did not experience a similar decline with the onset of stock market competition between the two New York exchanges. In addition, the group with Consolidated trading experienced a decline in the average NYSE volume of almost 15 percent (8,102 shares vs. 6,883 shares) while the volume for those without Consolidated trading increased by 25 percent in the period of competition (382 shares vs. 478 shares). Table 9 reports the results for the estimation of our basic model over the pre- and Consolidated period. We report four specifications that examine the determinants of the absolute and relative bid-ask spreads that omit and include company fixed effects. Column A of Table 9 reports the model with the absolute bid-ask spread as the dependent variable. The results indicate that the absolute spread is positively related to the closing price, negatively related to

individual security volume, and positively related to the standard deviation of returns. All coefficients are significant at the one percent level of significance.

The dummy variable for the presence of Consolidated trading indicates that absolute spreads are negatively related to the onset of competition from the Consolidated exchange. The coefficient on the Consolidated dummy is also significant at the one percent level. The results suggest that the bid-ask spreads were approximately 11.6 ($e^{-.123}$-1) percent lower in the Consolidated period.

In Column B of Table 9, we include company specific fixed effects to capture unobserved heterogeneity across firms. This necessitates excluding the standard deviation variable because it does not vary by observation across an individual security. The coefficients on security volume and the Consolidated dummy remain negative and significant at the one percent level and the coefficient estimate rises to 14.3 percent. The closing price is now negatively and significantly related to absolute spreads after controlling for fixed effects.

Column C of Table 9 reports the results using the relative spread as the dependent variable. Higher security volume, higher closing prices, and higher volatility are all negatively and significantly related to the relative spread. The presence of the Consolidated results in a reduction in relative spreads of approximately 11.3 ($e^{-.120}$-1) percent. We obtain similar results when we control for company specific fixed effects in Column D.

The ideal test of the effects of the Consolidated would be to have a control group of actively traded securities on the NYSE that had some prohibition on Consolidated trading. Without such a control group, we estimate models similar to those presented in Table 9 for the Boston Stock Exchange in order to determine whether or not the results are driven by overall changes in equity markets during this time period. The Boston Stock Exchange serves the purpose as a quasi-control group because it predominantly traded different stocks in the same industry --railroad and telephone stocks-- that did not trade on the Big Board. Moreover, the New York financial press regularly printed a list of stock prices on the Boston Stock Exchange. The

regional exchange therefore provides a test of whether a railroad or telephone specific shock can account for the statistically significant decline in NYSE bid-ask spreads with the Consolidated's decision to trade NYSE listed stocks. The empirical results for Boston, presented in Table 9A, indicate a similar relationship between spreads and control variables. However, the dummy variable for the presence of Consolidated trading is never significantly different than zero. Although the coefficient for competition is negative for Boston, it is less than half the size of the competition coefficient for the NYSE. This suggests that the observed relationship between Consolidated trading and NYSE spreads was the result of competition.

While the analysis in Table 9 controls for individual security effects across the pre- and Consolidated time periods, it is possible that changes in overall market conditions rather than the existence of the Consolidated led to lower bid-ask spreads. We control for overall market conditions with several variables including aggregate NYSE volume, the concentration of trading volume, and the broker call rate. Our measure of aggregate volume, $WVOL_t$, is NYSE weekly volume for a given observation (the sum of total NYSE volume for the day included in the sample and the five previous days of trading). Davis, Neal and White (2005) find that higher total volume on the NYSE increases bid-ask spreads if the "Big Board" has reached its capacity constraint for trading stocks. We also include the concentration ratio of volume for the four highest volume firms, $CONC_t$, to account for the fact that high volume securities have lower bid-ask spreads – if trading becomes more concentrated in high volume securities, then bid-ask spreads should fall. We also include the ratio of a security's NYSE volume to total NYSE volume on that day, $SHARE_{it}$, to control for the extent to which the Consolidated was trading only the most active NYSE securities. Finally, we include the broker's call rate as a measure of the cost of carrying an inventory of securities. The white noise error term is given by ε_{it}. The extended model can be written as:

$$SPREAD_{it} = \alpha_0 + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \beta_5 WVOL_{it} + \beta_6 CALL_t + \beta_7 SHARE_{it} + \beta_8 CONC_t + \varepsilon_{it} \quad (2)$$

In Table 10 we report the results of estimating the model with the additional control variables. While each of these additional variables is generally significant in the regression, they have little effect on the other variables or the overall fit of the model. The exception is the individual security volume measure. The individual security volume variable is no longer significantly different from zero because the variable is highly correlated with total NYSE volume.

In all the specifications reported in Table 10, the presence of competition from the Consolidated is associated with a reduction in absolute and relative spreads of approximately 13 percent. The Consolidated dummy is significant at the one percent level in the four different specifications. Moreover, the impact of the Consolidated on spreads is remarkably consistent across the specifications presented in Tables 9 and 10 and indicates that the introduction of the Consolidated is associated with a non-trivial reduction in bid-ask spreads on the NYSE. Table 10A reports an analysis of bid-ask spreads for the Boston Exchange using additional control variables. Again, we find that bid-ask spreads on the regional exchange did not significantly decline when the Consolidated Stock Exchange began to trade NYSE-listed stocks.

The baseline results are also consistent across a series of robustness checks not reported. We obtained similar findings when we included every security from *The New York Times* rather than focusing only on securities with positive NYSE volume on a given day. We also estimated the model after excluding securities that appeared only in the pre- or Consolidated period and have also restricted the sample to only those firms that consistently traded in both periods, something akin to a matched panel. The results are unaffected by these changes. The results are also robust to excluding securities with closing prices of $1 or less and $5 or less. Finally, we obtain similar results if we exclude securities trading at the binding spread of one-eighth.[8]

[8] We also find evidence that NYSE seat prices declined 20 percent in the first six months that the Consolidated began to trade NYSE listed stocks. We are unable to formally test this hypothesis given that the NYSE did not report any trades in the seat market in the three-year period before the Consolidated began to compete head-to-head with the Big Board. We also do not have Consolidated seat prices from this period.

B. The Effects of Long-Run Competition

In order to study the long-run effect of competition on NYSE bid-ask spreads, we estimate a panel regression of NYSE bid-ask spreads on variables proxying for competition from the Consolidated, firm-specific variables that affect spreads, and other variables that control for market conditions over time. *The New York Times'* brief lapse in reporting trading volume of NYSE stocks on the Consolidated from April through August 1886 limits our long-run analysis to the period September 1886 to February 1926. We sampled data from the last trading day of each month and collected firm-specific information on bid-ask spreads, trading volume on the NYSE, and trading volume of NYSE stocks bought and sold on the Consolidated Stock Exchange (if any). We also collected data on NYSE total monthly volume and the closing monthly broker call rate as additional control variables for the empirical analysis.

We focus our analysis on the common stocks in the Dow Jones Indices. We use the original Dow Jones Index with 12 stocks from September 1886 until October 1896, when the index is divided into the 20 stock Dow Jones Railroad Index and the 12 stock Industrial Index. We collected data from *The New York Times* for each security in the index at a given point in time and rely on Farrell (1972) for changes in the composition of the indices.

We employ the same empirical analysis used in Section 2 where the natural log of the absolute or relative spread is a function of a security's volume, its closing price, individual security volatility and competition. The only difference in the specification is that we now employ two different measures for the competition variable. The first is an estimate of the Consolidated's fraction of the volume of trading in a given NYSE listing, defined as [Consolidated Volume/(NYSE Volume + Consolidated Volume)]. Since this variable is measured in logs, we replace all zeros with a small positive value before taking the natural log for the observations where the Consolidated's share is zero. The basic tenor of the results remains unchanged by including shares with a zero value. The second measure of competition is a dummy variable that takes a value of one if a security traded on the Consolidated on a given day. The two

measures of competition have a pair wise correlation of 0.95, so we do not use them in the same regression.

Table 11 reports the summary statistics for the data used in the analysis of the effects of the Consolidated over time. The absolute bid-ask spread averages 0.414 and the relative bid-ask spread averages 0.627 percent. These bid-ask spread values are lower than those reported for all NYSE stocks in Table 5, which reflects the fact that the firms in the Dow Jones Indices are relatively liquid. Individual daily security volume on the NYSE averages 10,626 shares, the closing price averages $88.239, and individual security return volatility over the entire sample period averages 11.348.

The Consolidated's share of total volume per security averages 11.21 percent, but ranges from zero to 99.5 percent. For the dataset of firms from the Dow Jones Index, the Consolidated traded in an average of 74.8 percent of the sample on a given day. Table 11 also reports summary statistics on the control variables used in the analysis. NYSE total monthly volume averages 14.7 million shares. A security's share of trading volume averages 3.742 percent and the concentration of trading in the four most heavily traded securities averages 63 percent. The broker's call rate averages four percent.

Table 12 reports the estimates of the basic model of the effects of the Consolidated over time. The first two columns report the model with the absolute bid-ask spread as the dependent variable. The first column has the natural log of Consolidated share as the measure of competition, while the second column has the simple Consolidated dummy as the measure of competition. Both the Consolidated share variable and the dummy variable for the presence of any Consolidated trading are negatively and significantly related to bid-ask spreads at the one percent level. A one percent increase in the share of the Consolidated volume results in a 3.6 percent decline in the absolute and relative bid-ask spreads and the presence of Consolidated trading reduces the bid-ask spread by about 20 ($e^{-.225}$-1) percent. The coefficients of volume, price level, and security volatility all have the expected signs and are significantly different from

zero. The next two columns report the basic model with the relative bid-ask spread as the dependent variable. Again, the two measures of competition are negatively and significantly related to bid-ask spreads on the NYSE. The coefficients of the other variables have the expected signs and are significantly different from zero.

Table 12 also presents the results when we control for security specific fixed effects and year effects. Here the variable for individual security volatility is omitted because it is estimated over the entire sample period for a given firm. The results are generally robust to changing the specification of the model with the Consolidated share variable producing a 2.8 percent to 3.0 percent reduction in spreads and the presence of Consolidated trading producing a decline in spreads of approximately 15 ($e^{-.163}$ -1) percent.

We also estimate the extended model --given in equation (2)-- that incorporates additional control variables to capture general market conditions. Table 13 presents the empirical results using the additional control variables with and without fixed effects. The competition variables always have a negative and statistically significant effect on spreads. Hence, both the presence and magnitude of competition by the Consolidated is associated with narrower bid-ask spreads on the NYSE over time.

As a complement to our long-run analysis, we also conducted an "event study" analysis of the effects of the initiation of trading by the Consolidated in a particular stock. To conduct this test, we searched for securities from our sample of Dow Index stocks that had distinct trading on the NYSE before also trading on the Consolidated. We then estimated the change in bid-ask spreads of the securities after the initiation of trading by the Consolidated. Unfortunately, most stocks that were in the Dow Indices tended to have heavy trading on both the NYSE and the Consolidated during the course of our sample period.

We identified four securities that fit our criterion: AT&T, Colorado Fuel & Iron, Northern Pacific and the Texas Company. We use these four stocks and estimate our baseline model where the dummy variable for the Consolidated is equal to one after the Consolidated

initiates trading. The results are presented in Table 14 and indicate that the initiation of Consolidated trading is significantly related to a decline in spreads, which is consistent with our other analysis. However, the results only reflect a small sample of stocks.

C. The End of the Consolidated

Another test of the effects of stock market competition is to examine how bid-ask spreads changed when the Consolidated ceased to be an important competitor. However, the gradual decline of the rival exchange --as opposed to an abrupt halt of trading on the Consolidated-- makes it difficult to identify the effects of the removal of competition on bid-ask spreads. Nevertheless, we attempt to provide some insight into this question by using the resignation of William Silkworth, President of the Consolidated Stock Exchange, on June 25, 1923 as a key event that signaled the demise of the rival exchange. At this time, the New York State Attorney General also closed several brokerage houses affiliated with the Consolidated. If we re-estimate the long-run models presented in Tables 12 and 13 and restrict the sample to the period after Silkworth resigns, the two competition variables are not statistically significant in the baseline or extended models. The results suggest that the Consolidated ceased to be a significant competitor after June 1923.[9]

The mean bid-ask spreads also increase from $0.41 to $0.45 in the post-Silkworth period with the fraction of absolute spreads at $0.5 or less decreasing from 83.7 percent of the sample to 77.9 percent of the sample. The data suggest that the rise in bid-ask spreads is of similar magnitude to the decline in spreads observed at the initiation of Consolidated trading. We also re-estimated the baseline and extended models over the 40-year panel, replacing our measures of competition with a dummy variable that takes the value of one after June 1923 and the value of zero for the earlier months. The results presented in Table 15 indicate that bid-ask spreads increased after June 1923. The results for the baseline model indicate a positive and significant

[9] These results are available from the authors on request.

coefficient on the post-Silkworth dummy for both absolute and relative spreads. The coefficient on the end-of-competition variable in the models without company fixed effects is remarkably similar in size --albeit with a different sign-- than we reported for the initiation of Consolidated trading. The results with fixed effects produce smaller relative coefficients, but still indicate that the demise of the Consolidated was accompanied by a statistically significant increase in bid-ask spreads.

The results are not as robust for the extended model. The coefficient estimates are statistically significant but the coefficient estimates are smaller when we do not control for company specific fixed effects. The results are positive but not statistically significant when we control for company specific factors. However, it is important to note that these results are achieved without a well defined end date for the Consolidated. As noted earlier, the Consolidated's share of total volume was decreasing in the second half of the sample period and as such one would expect its end would produce smaller effects than its beginning. The fact that the onset of competition was associated with a large rise in the Consolidated's market share while the demise of the exchange coincided with a gradual decline in market share makes finding any result at the end of the exchange less likely.

Overall, we interpret the empirical analysis as strong evidence that head-to-head competition between the Consolidated and the NYSE lowered bid-ask spreads on the Big Board. NYSE bid-ask spreads fell with the onset of competition and increased when the Consolidated ceased to be an important competitor. Moreover, the coefficients on the two competition variables in the 40-year panel models are quite consistent across the different specifications, suggesting that the analysis does not suffer from an omitted variable. For an omitted variable to explain the results, it would have to cause NYSE bid-ask spreads to suddenly fall in 1885, rise from 1923 until February 1926, and be uncorrelated with the two measures of competition in the 40-year panel model. This seems unlikely given the historical and empirical evidence.

D. The NYSE-Consolidated Rivalry and Institutional Change

Although the empirical evidence suggests that head-to-head competition between the NYSE and the Consolidated reduced bid-ask spreads, the historical record indicates that the stock market rivalry also played an important role in bringing about some important institutional changes on the NYSE. The Big Board sought institutional innovations and rule changes to increase its market share and limit competition from the Consolidated. For example, the NYSE adopted the Consolidated's clearinghouse model for processing stock and bond transactions in 1892 after ignoring complaints about the lack of transparency on the Big Board (Annual Reports of the Consolidated Stock Exchange) for many years.[10] The *Commercial and Financial Chronicle* hailed the establishment of a clearinghouse as an important innovation that increased the transparency of stock transactions on the Big Board.

> We join most heartily in wishing this attempt [to introduce a clearinghouse] full and speedy success. If it does no more than put an end to the loose methods of business which have hitherto obtained in Wall Street, especially with regard to the delivery of securities and the certification of checks, its inauguration will prove a most fitting celebration of the centennial anniversary of the Exchange. (April 30, 1892, p. 700)

Michie (1986, 1987) notes that the NYSE attempted to limit its membership and listings. NYSE listing and membership policy encouraged the development of alternative trading venues for securities and brokers that could not gain access to the Big Board. Although the NYSE opened an unlisted department to trade Consolidated stocks not listed on the Big Board, the exchange did not adjust the size of its membership. As a result, the Consolidated served as a home for brokers and floor traders that could not obtain a membership on the NYSE.

Unwilling to expand its membership, the NYSE looked for other methods to compete with the Consolidated. One possible solution to the problem was to forge a relationship with the curbstone brokers on Wall Street. During the early years of its rivalry with the Consolidated Stock Exchange, the NYSE developed a symbiotic relationship with curb brokers on Wall Street

[10] The Consolidated Stock Exchange was the first American exchange to use a clearing house to settle financial transactions. The NYSE rival modeled its clearing house after the London market (Nelson, 1907).

that were also not members of the rival exchange. After several years of discussion, the New York Curb Market Association (NYCMA) created the New York Curb Market in May 1910. The Constitution of the NY Curb Market prohibited its brokers from trading stocks listed on the NYSE. In turn, the NYSE agreed to close its unlisted department that was originally formed to compete with the Consolidated Stock Exchange in 1885 (Doede, 1967).

The curb brokers did not conduct dealings in stocks listed on the NYSE and focused its business on unlisted securities and bonds (Doede, 1967). If a firm was successful and profitable on the curb market, then the company often left the exchange and listed on the NYSE. This was an opportunity not afforded by the Consolidated once it focused on NYSE securities. Other firms, such as Standard Oil, remained on the curb market and did not join the Big Board when given the opportunity because the firm refused to comply with NYSE listing rules on public disclosure of financial information. Michie (1987, p. 207) notes "The Curb was slowly integrated into the securities market and given a specific role to play, in a way the Consolidated was never allowed to do." The Curb provided an outlet for both the securities the NYSE would not list and the brokers the NYSE would not take as members without competing directly with the NYSE. Doede (1967) and Sobel (1972) argue that the growth of the Curb market likely eroded the Consolidated's market share.

The NYSE also introduced several additional rule changes after the onset of competition. The NYSE extended its trading hours in 1887. Five years later, the Big Board recommended that listed firms send shareholders an annual report with an income statement and balance sheet. By the turn of the century, the NYSE required all listed companies to supply regular financial statements. The rule changes increased the transparency and attractiveness of trading on the NYSE for investors. Although we do not have direct evidence that the NYSE adopted these rules as a competitive response to the Consolidated, these efficiency enhancing changes were implemented during a period of intense stock market competition as predicted by some theoretical models (Huddart, Hughes, and Brunnermeier, 1999).

E. Price Discovery

Beginning July 7, 1912, the Consolidated opened 30 minutes (9:30AM) before the NYSE. The Consolidated used a call market to establish opening prices in this period. The practice of early opening continued until July 30, 1914, when both exchanges closed with the outbreak of World War I. When the two rival exchanges reopened on December 12, 1914, the Consolidated apparently resumed trading at 10:00AM given that the financial press no longer reported trading activity on the rival exchange in the half hour before the start of NYSE trading. This two-year window provides an opportunity to test whether the Consolidated contributed to the price discovery process given that we lack detailed transaction level data to perform a more rigorous analysis. We employ a technique used by Silber (2006) to determine the extent to which opening prices on the Consolidated contained new information that would be incorporated into NYSE opening prices. Our variant of Silber's model can be written as follows:

$$NYSEOPEN_{it} = \alpha_0 + \beta_1 NYSECLOSE_{it-1} + \beta_2 CONSOLIDATEDOPEN_{it} + \varepsilon_{it} \qquad (3).$$

Equation (3) tests whether opening prices on the Consolidated predict opening prices on the NYSE after controlling for closing prices on the Big Board from the previous day. We collected weekly data for Friday's opening price and Thursday's closing price for all stocks that traded on the Consolidated and the NYSE. Then we matched stocks with a Friday opening price on the NYSE, $NYSEOPEN_{it}$, with securities that had a Friday opening price on the Consolidated, $CONSOLIDATEDOPEN_{it}$, and a Thursday closing price for the NYSE, $NYSECLOSE_{it}$. The estimated coefficients along with robust standard errors are presented below. The model was estimated with 3,604 observations.

$$NYSEOPEN_{it} = \underset{(0.006)}{-0.006} + \underset{(0.032)}{0.304} NYSECLOSE_{it-1} + \underset{(0.032)}{0.695} CONSOLIDATEDOPEN_{it} \qquad R^2 = 0.99$$

The slope coefficients are significant at the one percent level. The coefficient for the opening price of the Consolidated is more than two times larger than the coefficient on NYSE closing prices for the previous day. This suggests that the Consolidated contributed to the price discovery process and was more than a free-riding exchange that traded off NYSE bid-ask quotes.

As a robustness check, we also estimate the model in returns where it is written as:

$$NYSERETURN_{it} = \alpha_0 + \beta_1 CONSOLIDATEDRETURN_{it} + \varepsilon_{it} \quad (4)$$

where $NYSERETURN_{it} = \log(NYSEOPEN_{it}) - \log(NYSECLOSE_{it-1})$ and $CONSOLIDATEDRETURN_{it} = \log(CONSOLIDATEDOPEN_{it}) - \log(NYSECLOSE_{it-1})$. The estimated coefficients and standard errors are:

$$NYSERETURN_{it} = -0.0003 + 0.277\ CONSOLIDATEDRETURN_{it} + \varepsilon_{it}$$
$$(0.001) \quad (0.043) \qquad R^2 = 0.123$$

The coefficient on the Consolidated return is significant at the 1 percent level. The point estimate on the Consolidated variable implies that the change between the NYSE closing price and the Consolidated opening price accounts for just over 50 percent of the total overnight return for a security on the NYSE. Again, this suggests that the Consolidated was capable of some form of price discovery. One concern with the results is that many stocks that traded on the NYSE also traded in London during the overnight period. If this were true, then opening stock prices on the Consolidated may just reflect information generated in the London market. To address this concern, we identified the securities that traded in London from *The Economist* and *The Times.* Excluding stocks that traded on the London market did not change the empirical results.[11] Moreover, the analysis also indicates that approximately 5 percent of the securities that traded on the Consolidated did not trade on the London market or the NYSE on a given day. Although these

[11] If we exclude the stocks that also traded in London, then the coefficient on the Consolidated in equation (3) drops to 0.611 and rises to .294 in equation (4). The coefficient estimates are still significant at the one percent level.

securities generally had trading volumes of less than 100 shares, it provides additional evidence that the Consolidated functioned as a primary market for some securities.

4. Summary and Conclusion

What are the effects of significant stock market competition on bid-ask spreads, the organization of financial exchanges, and the optimal number of financial exchanges in the marketplace? To provide some insight into these questions, we examine the nature and magnitude of the stock market rivalry between the Consolidated Stock Exchange and the NYSE. The Consolidated competed directly with the Big Board and garnered an annual market share as high as 60 percent of the Big Board's listings. For more than forty years, the ratio of Consolidated to NYSE volume averaged more than 23 percent. Consistent with modern day competitors, the Consolidated focused its rivalry on the relatively more liquid listings of the NYSE (e.g., Easley, Kiefer and O'Hara (1996), Battalio (1997)). We also find that the NYSE responded to competition by narrowing its bid-ask spreads. Our estimates indicate that the onset of head-to-head competition was associated with more than a 10 percent reduction in NYSE bid-ask spreads while bid-ask spreads for our quasi-control group of stocks on the Boston Stock Exchange did not significantly change. Bid-ask spreads on the NYSE increased 42-years later after a series of scandals and investigations led to the demise of the Consolidated.

The analysis also suggests that the presence of significant head-to-head competition led to important institutional changes on Wall Street. For example, the NYSE adopted the Consolidated's clearinghouse model to process financial transactions to improve the transparency of stock trades. The use of a clearinghouse on the NYSE came only after the onset of significant competition from the Consolidated, despite years of complaints by investors about the lack of transparency on the Big Board. The rivalry also played an important role in the development of the modern NY Curb Market (American Stock Exchange) as the NYSE sought to forge an alliance with the curbstone brokers to reduce competition from the Consolidated. While our

analysis does not provide a public policy prescription for the optimal number of financial exchanges in the marketplace, the results suggest that significant competition (or the potential for significant competition) has historically forced the NYSE to adapt and implement efficiency enhancing changes that benefit investors and firms.

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Data Appendix

In this Appendix, we describe the sources for and the availability of the main variables in our analysis: Aggregate New York Stock Exchange trading volume, aggregate Consolidated Stock Exchange trading volume, average New York Stock Exchange bid-ask spreads, as well as firm-specific data on NYSE bid-ask spreads, NYSE volume, and the volume on the Consolidated Stock Exchange of NYSE listings.

Aggregate New York Stock Exchange Trading Volume

Aggregate trading volume for the New York Stock Exchange comes from two sources, the *New York Times* and the website of the NYSE. For the years 1875 through 1887, the data are hand collected on a daily basis from the *New York Times*. For 1888 to 1926, the data are taken from the website of the NYSE. The data for 1926 are for January and February only. The only interruption in the data is the period from July 31, 1914, through December 11, 1914, when the NYSE closed during World War 1.

Aggregate Consolidated Stock Exchange Trading Volume

Data on aggregate trading volume for the Consolidated Stock Exchange are hand collected from the *New York Times*. The data begin on February 17, 1885, when the *New York Times* separately reports NYSE-listed stocks within the volume for the New York Mining Exchange. As of Monday March 9, 1885, the *New York Times* reports the sales of NYSE-listed stocks under the name of the Consolidated Petroleum Exchange Board. For a brief time in 1886, the *New York Times* does not report the trading of NYSE-listed stocks on the Consolidated Exchange. The lapse in reporting occurs between April 15, 1886 and September 4, 1886. The last day the *New York Times* reports trading volume for the Consolidated Stock Exchange is February 16, 1926.

Average New York Stock Exchange Bid-Ask Spreads

Bid-ask spread data for the New York Stock Exchange are taken primarily from the *New York Times*. The *Commercial and Financial Chronicle* serves as a secondary source for certain years when the *New York Times* did not report bid-ask spreads.

Our analysis of NYSE bid-ask spreads reports average estimates for a single day for the years 1875 to 1926. The date chosen for analysis tended to be at the end of January or the beginning of February of a given year, although there were some exceptions based on data availability. Appendix Table A sketches the dates and sources for this data. For 1875 to 1881, the *New York Times* reports bid-ask spreads for Saturday trading on the following Monday. These data on spreads are matched with the data for Saturday trading volume that is reported in the Sunday *New York Times*.

Beginning on May 24, 1882, the *New York Times* reports NYSE bid-ask spreads on a daily basis. The data on daily bid-ask spreads continue through April 14, 1886. Between April 15, 1886, and May 12, 1893, the *New York Times* does not report bid-ask spreads for the NYSE. In this time interval, we gather bid-ask spread data from the *Commercial and Financial Chronicle*. The bid-ask spread data are reported for Thursday trading and are matched with the appropriate trading volume data from the *New York Times*.

On May 13, 1893, the *New York Times* resumes reporting of NYSE bid-ask spreads on a daily basis. These data are used through February 1926.

Firm-Specific Data

We also employ firm specific data on NYSE bid-ask spreads, NYSE volume, and the volume of NYSE-listings on the Consolidated Stock Exchange. The data are taken from the *New York Times*.

Appendix Table A. Overview of Average Bid-Ask Spread Data

Year	Calendar Date	Day of Week	Data Source
1875	January 23	Saturday	New York Times
1876	January 22	Saturday	New York Times
1877	January 27	Saturday	New York Times
1878	January 26	Saturday	New York Times
1879	February 1	Saturday	New York Times
1880	February 2	Saturday	New York Times
1881	January 29	Saturday	New York Times
1882	May 26	Friday	New York Times
1883	January 26	Friday	New York Times
1884	January 18	Friday	New York Times
1885	March 31	Tuesday	New York Times
1886	January 29	Friday	New York Times
1887	February 3	Thursday	Commercial and Financial Chronicle
1888	February 2	Thursday	Commercial and Financial Chronicle
1889	February 14	Thursday	Commercial and Financial Chronicle
1890	February 13	Thursday	Commercial and Financial Chronicle
1891	February 19	Thursday	Commercial and Financial Chronicle
1892	February 18	Thursday	Commercial and Financial Chronicle
1893	June 30	Thursday	New York Times
1894	January 31	Wednesday	New York Times
1895	January 31	Thursday	New York Times
1896	January 31	Friday	New York Times
1897	January 29	Friday	New York Times
1898	January 31	Monday	New York Times
1899	January 31	Tuesday	New York Times
1900	January 31	Wednesday	New York Times
1901	January 31	Thursday	New York Times
1902	January 31	Friday	New York Times
1903	January 30	Friday	New York Times
1904	January 29	Friday	New York Times
1905	January 31	Tuesday	New York Times
1906	January 31	Wednesday	New York Times
1907	January 31	Thursday	New York Times
1908	January 31	Friday	New York Times
1909	January 29	Friday	New York Times
1910	January 31	Monday	New York Times
1911	January 31	Tuesday	New York Times
1912	January 31	Wednesday	New York Times
1913	January 31	Friday	New York Times
1914	January 30	Friday	New York Times
1915	January 29	Friday	New York Times
1916	January 31	Monday	New York Times
1917	January 31	Wednesday	New York Times
1918	January 31	Thursday	New York Times
1919	January 31	Friday	New York Times
1920	January 30	Friday	New York Times
1921	January 31	Monday	New York Times
1922	January 31	Tuesday	New York Times
1923	January 31	Wednesday	New York Times
1924	January 31	Thursday	New York Times
1925	January 30	Friday	New York Times
1926	January 29	Friday	New York Times

Figure 1: Absolute Bid-Ask Spreads on the NYSE and Regional Exchanges around the Initiation of Consolidated Trading (January 11, 1883 - April 9, 1886)

This figure reports the reported absolute bid-ask spreads for all securities on the New York Stock Exchange and the universe of stocks trading on a selected set of the leading regional exchanges (Baltimore, Boston, and Philadelphia) for the period from 1875 to 1884. *Absolute bid-ask spread* is the closing bid-ask spread for a given day. Data are taken from the *New York Times*.

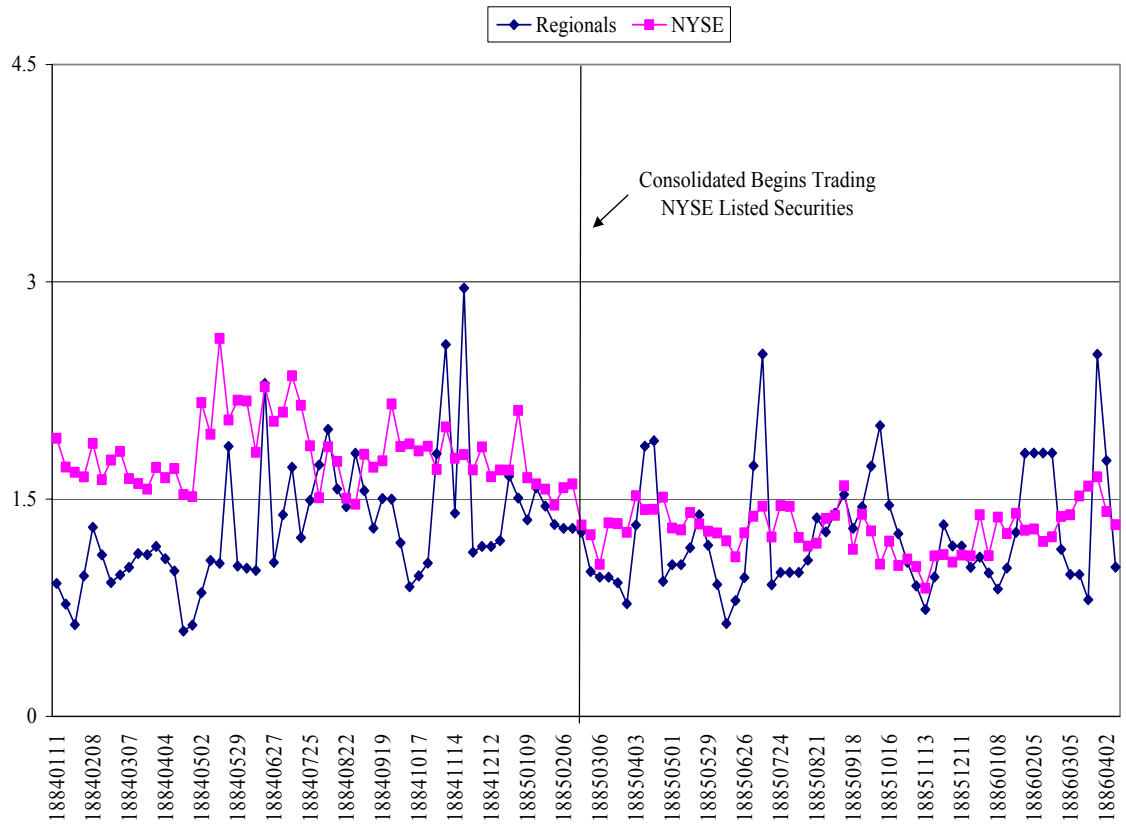

Table 1. NYSE Trading Volume: 1875 to 1884.

This table reports data on trading volume (shares of common stock) on the New York Stock Exchange for the period from 1875 to 1884. Data are taken from the *New York Times*.

Year	Annual Total	Daily Average	# Trading Days
1875	52,784,010	173,632	304
1876	39,893,720	131,229	304
1877	49,423,658	162,045	305
1878	39,863,540	131,130	304
1879	73,545,245	241,925	304
1880	94,825,866	309,888	306
1881	112,549,315	371,450	303
1882	112,860,374	373,710	302
1883	95,482,244	316,166	302
1884	95,391,386	312,759	305

Table 2. NYSE Bid-Ask Spreads: 1875 to 1884.

This table reports data on bid-ask spreads on the New York Stock Exchange for 1875 to 1884. One day from each year is sampled. See the Data Appendix for the specific dates. *Spread* is the median closing bid-ask spread for a given date. *Relative* is the closing bid-ask spread in percentage terms [(ask-bid)/((ask+bid)/2)]. *Most heavily traded stock* is the firm with the greatest number of shares traded on a given date. Data are from the *New York Times*.

	All firms with quotes			Firms with quotes and volume				
Year	# obs	Spread	Relative	# obs	Spread	Relative	Most heavily traded stock	Spread
1875	26	0.25	0.40%	26	0.25	0.40%	Western Union	0.125
1876	32	0.25	0.47%	26	0.1875	0.39%	Lake Shore	0.125
1877	32	0.50	0.94%	20	0.25	0.72%	Lake Shore	0.125
1878	37	0.50	1.03%	20	0.25	0.64%	Lake Shore	0.125
1879	37	0.50	0.64%	28	0.25	0.59%	Delaware Lackawanna	0.125
1880	80	0.50	0.66%	64	0.4375	0.66%	New York Lake Erie	0.125
1881	85	0.25	0.75%	73	0.25	0.51%	Ontario and Western	0.125
1882	102	0.75	1.39%	60	0.25	0.72%	Wabash preferred	0.125
1883	100	0.50	1.20%	64	0.25	0.48%	Union Pacific	0.125
1884	112	0.75	2.33%	66	0.25	0.77%	Western Union	0.125

Table 3. NYSE and Consolidated Trading Volume, 1885 to 1926.

Year	NYSE Volume	Consolidated Volume	NYSE + Consolidated	Consolidated/NYSE
1885	82,396,922	7,179,424	89,576,346	8.71%
1886	100,152,905	19,933,994	120,086,899	19.90%
1887	83,412,220	33,322,181	116,734,401	39.95%
1888	62,864,152	28,589,377	91,453,529	45.48%
1889	61,939,633	27,907,618	89,847,251	45.06%
1890	58,221,462	29,514,779	87,736,241	50.69%
1891	64,422,981	27,398,721	91,821,702	42.53%
1892	80,424,189	33,309,819	113,734,007	41.42%
1893	68,203,618	27,667,558	95,871,176	40.57%
1894	33,052,099	20,123,341	53,175,440	60.88%
1895	51,897,895	17,790,338	69,688,233	34.28%
1896	41,655,649	15,224,526	56,880,175	36.55%
1897	63,636,575	18,588,519	82,225,094	29.21%
1898	86,188,403	21,593,599	107,782,002	25.05%
1899	120,731,589	34,287,305	155,018,894	28.40%
1900	102,194,172	32,339,253	134,533,425	31.64%
1901	221,808,064	50,560,361	272,368,425	22.79%
1902	162,930,210	38,186,239	201,116,448	23.44%
1903	137,717,237	37,886,155	175,603,392	27.51%
1904	157,582,668	44,305,509	201,888,177	28.12%
1905	211,502,002	46,967,181	258,469,183	22.21%
1906	221,739,160	42,579,119	264,318,278	19.20%
1907	156,874,644	44,557,893	201,432,537	28.40%
1908	165,221,723	39,274,667	204,496,390	23.77%
1909	197,818,514	30,056,626	227,875,139	15.19%
1910	161,436,368	27,609,700	189,046,068	17.10%
1911	125,006,647	18,892,837	143,899,484	15.11%
1912	132,689,097	14,712,271	147,401,368	11.09%
1913	82,949,155	12,172,827	95,121,982	14.68%
1914*	47,421,197	5,970,339	53,391,536	12.59%
1915	172,496,804	12,353,951	184,850,755	7.16%
1916	232,633,124	20,018,974	252,652,098	8.61%
1917	184,767,325	20,306,104	205,073,428	10.99%
1918	142,392,667	11,298,003	153,690,671	7.93%
1919	315,181,380	28,669,666	343,851,046	9.10%
1920	228,049,127	27,267,772	255,316,899	11.96%
1921	172,922,936	44,728,185	217,651,121	25.87%
1922	260,276,700	48,665,596	308,942,296	18.70%
1923	236,132,478	26,790,253	262,922,731	11.35%
1924	283,592,481	21,088,295	304,680,776	7.44%
1925	463,924,822	20,003,142	483,927,964	4.31%
1926**	61,636,700	783,494	62,420,194	1.27%
mean	145,192,802	26,916,083	172,108,886	23.48%
median	135,203,167	27,504,210	154,354,782	22.50%
maximum	463,924,822	50,560,361	483,927,964	60.88%
minimum	33,052,099	783,494	53,175,440	1.27%

* markets closed from August until mid-December ** January and February only
Source: NYSE and *New York Times*

Table 4. Comparison of the Number of Stocks Traded on the NYSE and Consolidated: 1885 to 1926

This table reports the number of NYSE-listed stocks traded on the NYSE and the Consolidated Exchange for 1885 to 1926. One day from each year is sampled. See the Data Appendix for specific dates and data sources. *All NYSE* is the number of NYSE listings on a given date with reported bid-ask quotes. *NYSE with Volume* is the number of NYSE listings on a given date with quotes and positive trading volume on the NYSE. *Consolidated with Volume* is the number of NYSE listings with volume on the Consolidated Exchange.

Year	All NYSE	NYSE with Volume	Consolidated With Volume	Consolidated as percent of All NYSE	Consolidated as percent of NYSE with Volume
1885	114	55	18	16%	33%
1886	117	72	24	21%	33%
1887	98	72	33	34%	46%
1888	127	78	39	31%	50%
1889	130	96	41	32%	43%
1890	160	80	30	19%	38%
1891	140	59	21	15%	36%
1892	146	99	55	38%	56%
1893	145	82	39	27%	48%
1894	149	78	25	17%	32%
1895	144	79	24	17%	30%
1896	167	90	29	17%	32%
1897	168	77	20	12%	26%
1898	195	136	34	17%	27%
1899	209	155	38	18%	25%
1900	221	151	40	18%	26%
1901	229	158	44	19%	28%
1902	223	134	37	17%	28%
1903	254	121	49	19%	40%
1904	255	128	53	21%	41%
1905	255	176	48	19%	27%
1906	265	161	49	18%	30%
1907	277	151	35	13%	23%
1908	269	111	35	13%	32%
1909	263	149	61	23%	41%
1910	270	139	53	20%	38%
1911	280	153	51	18%	33%
1912	289	155	50	17%	32%
1913	333	147	44	13%	30%
1914	311	160	51	16%	32%
1915	254	138	51	20%	37%
1916	347	214	76	22%	36%
1917	399	227	63	16%	28%
1918	397	220	73	18%	33%
1919	412	189	65	16%	34%
1920	488	247	88	18%	36%
1921	548	273	145	26%	53%
1922	584	329	198	34%	60%
1923	669	406	201	30%	50%
1924	741	441	208	28%	47%
1925	773	507	276	36%	54%
1926	863	565	127	15%	22%
			Median	18%	33%

Table 5. NYSE Bid-Ask Spreads: 1885 to 1926.

This table reports median bid-ask spreads for the NYSE for the 1885 to 1926 period. One day from each year is sampled. See the Data Appendix for specific dates and sources. *All NYSE with Quotes* is the spread for all NYSE listings with quotes on a given date. *Volume, not Consolidated* is the spread for NYSE listings with volume on the NYSE but not on the Consolidated Exchange. *Volume, also Consolidated* is the spread for NYSE listings with volume on both the NYSE and the Consolidated Exchange.

	All NYSE with Quotes			Volume, not Consolidated			Volume, also Consolidate		
Year	# obs	Spread	Relative	# obs	Spread	Relative	# obs	Spread	Relative
1885	114	1.00	3.93%	37	0.75	2.93%	18	0.125	0.30%
1886	117	0.75	2.17%	48	0.50	1.39%	24	0.125	0.46%
1887	98	0.75	1.43%	39	0.75	1.40%	33	0.25	0.46%
1888	127	0.875	1.90%	39	0.75	1.76%	39	0.375	1.09%
1889	130	0.625	1.58%	55	0.75	1.85%	41	0.25	0.51%
1890	160	1.00	2.67%	50	1.00	2.57%	30	0.25	0.61%
1891	140	1.00	2.63%	38	0.75	1.73%	21	0.25	0.60%
1892	146	0.75	1.60%	44	0.813	1.60%	55	0.375	0.65%
1893	145	1.50	4.44%	43	1.00	3.05%	39	0.375	0.89%
1894	149	1.00	3.60%	53	0.50	2.14%	25	0.25	0.72%
1895	144	0.938	3.26%	55	0.50	2.30%	24	0.25	0.65%
1896	167	1.00	3.21%	61	0.625	2.11%	29	0.25	0.48%
1897	168	1.00	3.64%	57	0.50	1.94%	20	0.25	0.46%
1898	195	0.50	2.30%	92	0.50	1.60%	34	0.188	0.41%
1899	209	0.50	1.35%	117	0.50	1.31%	38	0.25	0.39%
1900	221	0.75	1.68%	111	0.50	1.38%	40	0.25	0.46%
1901	229	0.50	1.26%	114	0.50	0.93%	44	0.125	0.34%
1902	223	0.75	1.28%	97	0.50	0.80%	37	0.125	0.32%
1903	254	1.00	1.75%	72	0.50	1.18%	49	.025	0.35%
1904	255	1.00	2.74%	75	0.75	1.63%	53	0.25	0.56%
1905	255	0.75	1.46%	128	0.50	1.26%	48	0.125	0.29%
1906	265	0.75	1.32%	112	0.50	0.73%	49	0.125	0.28%
1907	277	1.00	2.22%	116	0.75	1.38%	35	0.125	0.32%
1908	269	1.50	4.38%	76	1.00	2.16%	35	0.125	0.50%
1909	263	0.875	1.80%	88	0.50	1.18%	61	0.25	0.51%
1910	270	1.00	2.28%	86	0.75	1.16%	53	0.375	0.72%
1911	280	0.75	1.53%	102	0.50	0.71%	51	0.25	0.41%
1912	289	1.00	2.14%	105	1.00	1.60%	50	0.25	0.47%
1913	333	1.25	2.41%	103	0.75	1.26%	44	0.25	0.44%
1914	311	1.00	2.00%	109	0.75	0.92%	51	0.25	0.47%
1915	254	1.00	2.69%	87	1.00	2.15%	51	0.375	0.90%
1916	347	1.00	1.87%	138	0.75	1.57%	76	0.25	0.62%
1917	399	1.00	1.94%	164	1.00	1.63%	63	0.25	0.55%
1918	397	1.125	2.96%	147	0.75	2.02%	73	0.25	0.57%
1919	412	1.00	2.67%	124	0.75	1.47%	65	0.375	0.77%
1920	488	1.00	2.02%	159	0.75	1.33%	88	0.375	0.67%
1921	548	1.00	3.17%	128	0.875	1.24%	145	0.375	1.24%
1922	584	0.875	2.73%	131	0.875	2.37%	198	0.375	1.11%
1923	669	0.75	1.89%	205	0.75	1.60%	201	0.375	0.90%
1924	741	0.50	1.77%	233	0.50	1.68%	208	0.25	0.87%
1925	773	0.625	1.41%	231	0.625	1.18%	276	0.25	0.78%
1926	863	0.50	1.23%	438	0.50	0.96%	127	0.25	0.60%
Median		1.00	2.08%		0.75	1.60%		0.25	0.53%

Table 6. Most Heavily Traded Stock: 1885 to 1926.

This table reports the most heavily traded stock on the NYSE and the Consolidated Exchange in the 1885 to 1926 period. One day from each year is sampled. See the Data Appendix for specific dates. For the most heavily traded stock on a given exchange, the table also reports the rank in volume on the rival exchange and the bid-ask spread of the stock on the NYSE.

Year	NYSE	Rank on Consol	NYSE Spread	Consolidated	Rank on NYSE	NYSE Spread
1885	Delaware Lackawanna	9	0.125	Chicago Milwaukee	8	0.125
1886	Delaware Lackawanna	3	0.125	Chicago Milwaukee	2	0.125
1887	Philadelphia & Reading	3	0.125	Lake Shore	6	0.25
1888	Chicago Milwaukee	2	0.125	Philadelphia & Reading	2	0.25
1889	Delaware Lackawanna	1	0.25	Delaware Lackawanna	1	0.25
1890	American Sugar	1	0.125	American Sugar	1	0.125
1891	Chicago Rock Island	1	0.25	Chicago Rock Island	1	0.25
1892	Philadelphia & Reading	2	0.125	NY & New England	7	0.125
1893	Louisville & Nashville	16	0.25	Chicago Milwaukee	2	0.125
1894	American Sugar	1	0.125	American Sugar	1	0.125
1895	Chicago Gas	2	0.125	Chicago Milwaukee	2	0.125
1896	Philadelphia & Reading	2	0.125	American Sugar	2	0.25
1897	Northern Pacific pref	7	0.125	American Sugar	2	0.125
1898	Chesapeake & Ohio	23	0.125	American Sugar	11	0.125
1899	American Sugar	1	0.125	American Sugar	1	0.125
1900	American Sugar	1	0.25	American Sugar	1	0.25
1901	Southern Pacific	1	0.125	Southern Pacific	1	0.125
1902	Southern Pacific	4	0.125	Amalgamated Copper	2	0.25
1903	Erie	1	0.125	Erie	1	0.125
1904	Pennsylvania	3	0.125	US Steel pref	2	0.25
1905	Union Pacific	3	0.125	US Steel pref	6	0.125
1906	Amalgamated Copper	1	0.125	Amalgamated Copper	1	0.125
1907	Reading	1	0.125	Reading	1	0.125
1908	Reading	1	0.125	Reading	1	0.125
1909	Reading	2	0.125	Union Pacific	3	0.125
1910	Reading	3	0.125	US Steel	2	0.125
1911	US Steel	1	0.125	US Steel	1	0.125
1912	US Steel	1	0.125	US Steel	1	0.125
1913	American Can	3	0.125	Reading	3	0.125
1914	US Steel	1	0.125	US Steel	1	0.125
1915	Reading	1	0.125	Reading	1	0.125
1916	US Steel	1	0.125	US Steel	1	0.125
1917	US Steel	1	0.125	US Steel	1	0.125
1918	US Steel	1	0.125	US Steel	1	0.125
1919	US Steel	1	0.125	US Steel	1	0.125
1920	Baldwin Locomotive	1	0.125	Baldwin Locomotive	1	0.125
1921	General Asphalt	2	0.125	Mexican Petroleum	3	0.50
1922	Studebaker Corp	2	0.125	Island Oil & Transport	17	0.25
1923	US Steel	4	0.125	California Petroleum	5	0.125
1924	General Motors	5	0.125	Studebaker Corp	3	0.125
1925	Independent Oil & Gas	37	0.25	Radio Corp of America	9	0.125
1926	Sinclair Oil	1	0.125	Sinclair Oil	1	0.125
	Median	1.5	0.125		1.5	0.125

Table 7. Summary Statistics of Pre- and Consolidated Period (December 28, 1883 - April 9, 1886)

This table reports the sample statistics for the trading data from the NYSE in the 120 weeks surrounding the initiation of trading of NYSE listed securities on the Consolidated Stock Exchange. One day, usually Friday, from each week is sampled. *Absolute bid-ask spread* is the closing bid-ask spread for a given day. The *relative bid-ask spread* is the closing bid-ask spread in percentage terms [(ask-bid)/((ask+bid)/2)]. The *individual security volume* is the total NYSE volume for the security for a given day. The *individual security closing price* is the NYSE closing price for that day. *Individual security volatility* is the standard deviation of a given security's return over the entire sample period. The *NYSE total weekly volume* is the total volume for all securities for a given day and the previous five days of trading. A *security's share of total volume* is that security's total NYSE volume for a given day divided by the total NYSE volume for that day. The *concentration ratio* is the sum of the volume for the four securities with the highest volume on a given day divided by the total NYSE volume for that day. The *broker's call rate* is the closing weekly call rate for the week for which other data are taken. The *presence of Consolidated trading* takes a value of one for all observations in the 60 weeks after February 17, 1885 and is zero for the observations in the 60 weeks before Feb 17, 1885. There are 7,036 observations for all variables.

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
		Full Sample (n = 7,036)			
absolute bid-ask spread	0.685	0.375	0.936	0.125	20.000
relative bid-ask spread (%)	2.776	1.067	5.004	0.090	133.333
individual security volume	5,251	600	13,032	5	171,516
individual security closing price	52.893	41.375	40.133	0.250	150.000
individual security volatility (%)	7.099	6.303	4.759	1.282	24.887
NYSE total weekly volume	1,990,360	1,919,794	715,420	714,709	4,500,137
security's share of total volume (%)	1.689	0.192	4.064	0.001	45.729
concentration ratio (%)	55.516	56.507	9.821	32.723	80.660
broker's call rate (%)	2.040	2.000	1.086	1.000	9.500
Presence of Consolidated trading (%)	53.681	100.000	49.867	0.000	100.000
		Pre-Consolidated Period (n = 3,259)			
absolute bid-ask spread	0.758	0.375	1.063	0.125	20.000
relative bid-ask spread (%)	3.040	1.130	5.246	0.095	133.333
individual security volume	5,790	550	14,671	5	171,516
individual security closing price	52.876	42.500	39.872	1.000	148.500
individual security volatility (%)	7.023	6.126	4.829	1.282	24.887
NYSE total weekly volume	1,899,926	1,876,306	556,089	869,380	3,404,115
security's share of total volume (%)	1.815	0.183	4.449	0.001	44.899
concentration ratio (%)	59.483	58.949	7.655	43.066	80.660
broker's call rate (%)	2.098	1.750	1.305	1.000	9.500
		Consolidated Period (n = 3,777)			
absolute bid-ask spread	0.622	0.375	0.806	0.125	10.000
relative bid-ask spread (%)	2.548	1.036	4.775	0.090	100.000
individual security volume	4,786	600	11,411	5	114,230
individual security closing price	52.907	40.125	40.362	0.250	150.000
individual security volatility (%)	7.165	6.383	4.689	1.282	24.887
NYSE total weekly volume	2,068,391	1,932,515	820,739	714,709	4,500,137
security's share of total volume (%)	1.579	0.204	3.697	0.001	45.729
concentration ratio (%)	52.093	53.551	10.189	32.723	72.868
broker's call rate (%)	1.990	2.000	0.851	1.000	5.500

Table 8. Summary Statistics of Pre- and Consolidated Period for Companies with and without Consolidated Volume (December 28, 1883 - April 9, 1886)

This table reports the sample statistics for the trading data from the NYSE in the 120 weeks surrounding the initiation of trading of NYSE listed securities on the Consolidated Stock Exchange. One day, usually Friday, from each week is sampled. *Absolute bid-ask spread* is the closing bid-ask spread for a given day. Individual Security Volume (both exchanges) is the sum of the NYSE and Consolidated volume for the day. All other variables are defined as in Table 7.

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
	Full Period, Firms without Consolidated Trading (n = 2,213)				
absolute bid-ask spread	1.292	1.000	1.329	0.125	20.000
relative bid-ask spread (%)	0.039	0.020	0.060	0.001	1.333
individual security volume (NYSE)	436	200	843	5	12,710
individual security closing price	63.626	52.000	44.810	1.000	150.000
individual security volatility (%)	0.066	0.064	0.046	0.013	0.164
	Full Period, Firms with Consolidated Trading (n = 4,823)				
absolute bid-ask spread	0.407	0.250	0.473	0.125	7.000
relative bid-ask spread (%)	0.023	0.008	0.044	0.001	1.000
individual security volume (NYSE)	7,460	1,200	15,229	5	171,516
individual security closing price	47.969	38.875	36.765	0.250	139.375
individual security volatility (%)	0.073	0.061	0.048	0.017	0.249
	Pre-Consolidated Period, Firms without Consolidated Trading (n = 976)				
absolute bid-ask spread	1.505	1.000	1.526	0.125	20.000
relative bid-ask spread (%)	0.046	0.023	0.074	0.001	1.333
individual security volume (NYSE)	382	200	723	5	12,710
individual security closing price	66.101	62.000	44.476	1.000	148.500
individual security volatility (%)	0.063	0.040	0.047	0.013	0.164
	Pre-Consolidated Period, Firms with Consolidated Trading (n = 2,283)				
absolute bid-ask spread	0.439	0.250	0.528	0.125	6.500
relative bid-ask spread (%)	0.024	0.008	0.038	0.001	0.435
individual security volume (NYSE)	8,102	1200	17,006	5	171,516
individual security closing price	47.223	38.500	36.301	1.125	131.500
individual security volatility (%)	0.073	0.061	0.049	0.017	0.249
	Consolidated Period, Firms without Consolidated Trading (n = 1,237)				
absolute bid-ask spread	1.124	0.875	1.122	0.125	10.000
relative bid-ask spread (%)	0.033	0.018	0.046	0.001	0.560
individual security volume (NYSE)	478	200	926	5	10,610
individual security closing price	61.673	47.375	44.994	1.250	150.000
individual security volatility (%)	0.069	0.065	0.045	0.013	0.164
	Consolidated Period, Firms with Consolidated Trading (n = 2,540)				
absolute bid-ask spread	0.378	0.250	0.415	0.125	7.000
relative bid-ask spread (%)	0.022	0.007	0.048	0.001	1.000
individual security volume (NYSE)	6,883	1200	13,409	5	114,230
individual security closing price	48.638	39.000	37.171	0.250	139.375
individual security volatility (%)	0.073	0.063	0.048	0.017	0.249
individual security volume (both exchanges)	7,764	1,288	15,724	5	158,790

Table 9. The Effect of Consolidated Trading on the NYSE in the Pre- and Consolidated Period (December 28, 1883 - April 9, 1886)

This table reports the results from the estimation of the following model:

$SPREAD_{it} = \alpha + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \varepsilon_{it}$

where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 7. COMP is a dummy variable that takes on a value of one for all observations in the 60 weeks after February 17, 1885 and the value of zero for the observations in the 60 weeks before Feb 17, 1885. The other variables are as defined as in Table 7 and are measured in natural logs. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A)	(B)	(C)	(D)
	dependent variable			
	natural log of absolute spread	natural log of absolute spread	natural log of relative spread	natural log of relative spread
natural log of individual security volume	-0.336*	-0.129*	-0.336*	-0.133*
	(0.004)	(0.006)	(0.004)	(0.006)
natural log of individual security closing price	0.370*	-0.186*	-0.619*	-1.150*
	(0.018)	(0.028)	(0.018)	(0.030)
natural log of individual security volatility	0.309*		0.319*	
	(0.027)		(0.027)	
presence of Consolidated trading	-0.123*	-0.154*	-0.120*	-0.151*
	(0.017)	(0.014)	(0.017)	(0.014)
constant	0.943*	0.695*	0.931*	0.585*
	(0.048)	(0.100)	(0.048)	(0.102)
company fixed effects included	no	yes	no	yes
Observations	7036	7036	7036	7036
R-squared	0.484	0.662	0.730	0.821

Table 9A. Bid-Ask Spreads on the Boston Exchange in the Pre- and Consolidated Period (December 28, 1883 - April 9, 1886)

This table reports the results from the estimation of the following model:

$SPREAD_{it} = \alpha + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \varepsilon_{it}$

where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 7. COMP is a dummy variable that takes on a value of one for all observations in the 60 weeks after February 17, 1885 and the value of zero for the observations in the 60 weeks before Feb 17, 1885. The other variables are as defined as in Table 7 and are measured in natural logs. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A) natural log of absolute spread	(B) natural log of absolute spread	(C) natural log of relative spread	(D) natural log of relative spread
natural log of individual security volume	-0.153* (0.009)	-0.067* (0.012)	-0.153* (0.009)	-0.068* (0.012)
natural log of individual security closing price	0.260* (0.018)	-0.146** (0.072)	-0.740* (0.018)	-1.111* (0.074)
natural log of individual security volatility	0.187* (0.032)		0.187* (0.032)	
presence of Consolidated trading	0.026 (0.036)	-0.042 (0.032)	0.026 (0.036)	-0.045 (0.032)
constant	-0.872* (0.086)	-0.269 (0.248)	-0.890* (0.085)	-0.391 (0.256)
company fixed effects included	no	yes	no	yes
Observations	1490	1490	1490	1490
R-squared	0.321	0.555	0.676	0.788

Table 10. The Effect of Consolidated Trading on the NYSE with Additional Control Variables in the Pre- and Consolidated Period (December 28, 1883 - April 9, 1886)

This table reports the results from the estimation of the following model:

$$SPREAD_{it} = \alpha_0 + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \beta_5 WVOL_{it} + \beta_6 CALL_t + \beta_7 SHARE_{it} + \beta_8 CONC_t + \varepsilon_{it}$$

where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 7. COMP is a dummy variable that takes on a value of one for all observations in the 60 weeks after February 17, 1885 and the value of zero for the observations in the 60 weeks before Feb 17, 1885. The other variables are as defined as in Table 7 but measured in natural logs. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A)	(B)	(C)	(D)
	dependent variable			
	natural log of absolute spread	natural log of absolute spread	natural log of relative spread	natural log of relative spread
natural log of individual security volume	-0.030	-0.016	-0.033	-0.018
	(0.037)	(0.030)	(0.037)	(0.030)
natural log of individual security closing price	0.348*	-0.226*	-0.641*	-1.188*
	(0.018)	(0.031)	(0.018)	(0.032)
natural log of individual security volatility	0.269*		0.280*	
	(0.028)		(0.027)	
presence of Consolidated trading	-0.137*	-0.143*	-0.134*	-0.141*
	(0.019)	(0.015)	(0.019)	(0.015)
natural log of NYSE total weekly volume	-0.135*	-0.055	-0.133*	-0.058***
	(0.042)	(0.034)	(0.042)	(0.034)
natural log of broker's call rate	0.079*	0.101*	0.075*	0.096*
	(0.025)	(0.020)	(0.025)	(0.021)
natural log of security's share of total volume	-0.312*	-0.124*	-0.309*	-0.126*
	(0.037)	(0.030)	(0.037)	(0.030)
natural log of concentration ratio	-0.246*	-0.023	-0.247*	-0.026
	(0.055)	(0.045)	(0.055)	(0.046)
constant	-0.871**	0.520	-0.894**	0.406
	(0.452)	(0.361)	(0.450)	(0.365)
company fixed effects included	no	yes	no	yes
Observations	7036	7036	7036	7036
R-squared	0.497	0.665	0.737	0.823

Table 10A. Bid-Ask Spreads on the Boston Exchange in the Pre- and Consolidated Period with Additional Control Variables (December 28, 1883 - April 9, 1886)

This table reports the results from the estimation of the following model:

$$SPREAD_{it} = \alpha_0 + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \beta_5 WVOL_{it} + \beta_6 CALL_t + \beta_7 SHARE_{it} + \beta_8 CONC_t + \varepsilon_{it}$$

where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 7. COMP is a dummy variable that takes on a value of one for all observations in the 60 weeks after February 17, 1885 and the value of zero for the observations in the 60 weeks before Feb 17, 1885. The other variables are as defined as in Table 7 but measured in natural logs. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A)	(B)	(C)	(D)
	dependent variable			
	natural log of absolute spread	natural log of absolute spread	natural log of relative spread	natural log of relative spread
natural log of individual security volume	-0.080*	-0.060*	-0.081*	-0.064*
	(0.027)	(0.023)	(0.027)	(0.023)
natural log of individual security closing price	0.246*	-0.192*	-0.749*	-1.155*
	(0.018)	(0.071)	(0.018)	(0.074)
natural log of individual security volatility	0.170*		0.171*	
	(0.032)		(0.032)	
presence of Consolidated trading	-0.057	-0.058	-0.056	-0.059
	(0.043)	(0.036)	(0.043)	(0.036)
natural log of broker's call rate	0.158*	0.129*	0.160*	0.131*
	(0.054)	(0.045)	(0.054)	(0.045)
natural log of security's share of total volume	-0.083*	-0.012	-0.082*	-0.010
	(0.028)	(0.024)	(0.028)	(0.024)
natural log of concentration ratio	0.045	0.103	0.046	0.104
	(0.078)	(0.066)	(0.078)	(0.066)
constant	-1.594*	-0.195	-1.603*	-0.303
	(0.249)	(0.295)	(0.248)	(0.300)
company fixed effects included	no	yes	no	yes
Observations	1490	1490	1490	1490
R-squared	0.337	0.561	0.684	0.79

Table 11. Summary Statistics of Long-Term Competition between the Consolidated and NYSE (September 1886 – February 1926)

This table reports the sample statistics for the trading data for the firms in the Dow Jones Industrial Average beginning in September 1886, and the Dow Jones Railroad Index beginning in October 1896. One day, usually the last day of the month, from each month is sampled. *Absolute bid-ask spread* is the closing bid-ask spread for a given day. The *relative bid-ask spread* is the closing bid-ask spread in percentage terms [(ask-bid)/((ask+bid)/2)]. The *individual security volume* is the total NYSE volume for the security for a given day. The *individual security closing price* is the NYSE closing price for that day. *Individual security volatility* is the standard deviation of a given security's return over the entire sample period. *NYSE total monthly volume* is the total volume for all securities for a given month. A *security's share of total volume* is that security's total NYSE volume for a given day divided by the total NYSE volume for that day. The *concentration ratio* is the sum of the volume for the four securities with the highest volume on a given day divided by the total NYSE volume for that day. The *broker's call rate* is the closing monthly call rate for the month for which other data is taken. The *Consolidated share of total volume* is the total volume for security i on the Consolidated divided by the total volume on the Consolidated for security i plus the total volume on security i on the NYSE for a given day. The *presence of Consolidated volume* takes on a value of one for all observations where the Consolidated had trading volume and 0 otherwise. There are 12,389 observations for each variable.

Variable	Mean	Median	Standard Deviation	Minimum	Maximum
absolute bid-ask spread	0.414	0.250	0.453	0.125	10.500
relative bid-ask spread (%)	0.627	0.378	0.846	0.051	18.182
individual security volume	10,626	2,700	26,069	4	489,444
individual security closing price	88.239	87.000	45.867	1.250	400.000
individual security volatility (%)	11.348	7.314	13.053	2.634	76.841
NYSE total monthly volume	14,700,000	12,898,720	9,304,893	1,667,854	79,600,000
security's share of total volume (%)	3.742	1.071	7.070	0.001	79.004
concentration ratio (%)	63.010	63.017	13.348	29.036	94.550
broker's call rate (%)	4.023	3.500	3.499	0.875	40.000
consolidated share of total volume (%)	11.210	6.593	13.682	0.000	99.514
presence of Consolidated volume (%)	74.816	100.000	43.409	0.000	100.000

Table 12. Long-Term Effects of Consolidated Trading on the NYSE (Sept. 1886 – Feb. 1926)

This table reports the results from the estimation of the following model:

$$SPREAD_{it} = \alpha + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \varepsilon_{it}$$

where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 10. We measure competition, COMP, in two different ways. The *natural log of Consolidated share* is the total volume for security i on the Consolidated divided by the total volume on the Consolidated for security i plus the total volume on security i on the NYSE for a given day. The *Consolidated presence* takes on a value of one for all observations where the Consolidated had trading volume and 0 otherwise. The other variables are as defined as in Table 10 but measured in natural logs. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
	dependent variable											
	ln of absolute spread	ln of absolute spread	ln of relative spread	ln of relative spread	ln of absolute spread	ln of absolute spread	ln of relative spread	ln of relative spread	ln of absolute spread	ln of absolute spread	ln of relative spread	ln of relative spread
natural log of individual security volume	-0.217*	-0.219*	-0.219*	-0.222*	-0.183*	-0.184*	-0.186*	-0.187*	-0.161*	-0.160*	-0.165*	-0.165*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
natural log of individual security closing price	0.272*	0.270*	-0.709*	-0.710*	0.219*	0.221*	-0.742*	-0.740*	0.177*	0.173*	-0.771*	-0.775*
	(0.011)	(0.011)	(0.012)	(0.012)	(0.015)	(0.015)	(0.017)	(0.017)	(0.016)	(0.016)	(0.021)	(0.021)
natural log of individual security volatility	0.053*	0.046*	0.061*	0.053*								
	(0.010)	(0.010)	(0.010)	(0.010)								
natural log of Consolidated Share	-0.036*		-0.036*		-0.023*		-0.029*		-0.028*		-0.028*	
	(0.002)		(0.002)		(0.003)		(0.003)		(0.003)		(0.003)	
Consolidated Presence		-0.225*		-0.221*		-0.167*		-0.163*		-0.167*		-0.164*
		(0.017)		(0.017)		(0.017)		(0.017)		(0.017)		(-0.017)
Constant	-0.691*	-0.369*	-0.736*	-0.420*	-0.835*	-0.590*	-0.977*	-0.737*	-1.262*	-1.027*	-1.443*	-1.212*
	(0.050)	(0.046)	(0.050)	(0.047)	(0.063)	(0.062)	(0.070)	(0.069)	(0.097)	(0.096)	(0.107)	(0.106)
company fixed effects	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
year fixed effects	no	no	no	no	no	no	no	no	yes	yes	yes	yes
Observations	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389
R-squared	0.353	0.349	0.545	0.543	0.430	0.427	0.599	0.597	0.470	0.469	0.626	0.625

Table 13. Long-Term Effects of Consolidated Trading on the NYSE with Additional Control Variables

This table reports the results from the estimation of the following model:
$SPREAD_{it} = \alpha_0 + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta 3 STDEVi + \beta_4 COMP_t + \beta_5 MVOL_{it} + \beta_6 CALL_t + \beta_7 SHARE_{it} + \beta_8 CONC_t + \varepsilon_{it}$
where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 10. The *Consolidated share* is the total volume for security i on the Consolidated divided by the total volume on the Consolidated for security i plus the total volume on security i on the NYSE for a given day. The *Consolidated presence* takes on a value of one for all observations where the Consolidated had trading volume and 0 otherwise. The other variables are as defined as in Table 10 but measured in natural logs. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)
						dependent variable						
independent variable	ln of absolute spread	ln of absolute spread	ln of absolute spread	ln of relative spread	ln of relative spread	ln of relative spread	ln of absolute spread	ln of absolute spread	ln of absolute spread	ln of relative spread	ln of relative spread	ln of relative spread
natural log of individual security volume	-0.172* (0.009)	-0.167* (0.009)	-0.173* (0.009)	-0.169* (0.009)	-0.121* (0.009)	-0.119* (0.009)	-0.125* (0.009)	-0.122* (0.009)	-0.038* (0.012)	-0.035* (0.012)	-0.037* (0.012)	-0.035* (0.012)
natural log of individual security closing price	0.257* (0.011)	0.253* (0.011)	-0.722* (0.012)	-0.726* (0.012)	0.171* (0.015)	0.170* (0.015)	-0.785* (0.019)	-0.786* (0.018)	0.185* (0.016)	0.182* (0.017)	-0.762* (0.021)	-0.766* (0.021)
natural log of individual security volatility	0.051* (0.010)	0.044* (0.010)	0.059* (0.010)	0.052* (0.010)								
natural log of Consolidated Share	-0.034* (0.002)		-0.033* (0.002)		-0.026* (0.003)		-0.026* (0.003)		-0.026* (0.003)		-0.025* (0.003)	
Consolidated Presence		-0.220* (0.017)		-0.215* (0.017)		-0.152* (0.017)		-0.148* (0.017)		-0.154* (0.017)		-0.150* (0.017)
natural log of NYSE total monthly volume	0.055* (0.012)	0.061* (0.012)	0.049* (0.012)	0.055* (0.012)	0.063* (0.012)	0.067* (0.012)	0.053* (0.013)	0.057* (0.013)	-0.022 (0.017)	-0.021 (0.017)	-0.025 (0.017)	-0.025 (0.017)
natural log of broker's call rate	0.116* (0.010)	0.115* (0.010)	0.116* (0.010)	0.115* (0.010)	0.093* (0.010)	0.092* (0.010)	0.093* (0.010)	0.093* (0.010)	0.032** (0.012)	0.033* (0.013)	0.033* (0.013)	0.033* (0.013)
natural log of security's share of total volume	-0.057* (0.009)	-0.063* (0.009)	-0.058* (0.009)	-0.064* (0.009)	-0.077* (0.010)	-0.081* (0.010)	-0.077* (0.010)	-0.080* (0.010)	-0.146* (0.012)	-0.148* (0.012)	-0.151* (0.012)	-0.153* (0.012)

natural log of concentration ratio	-0.100* (0.028)	-0.094* (0.028)	-0.111* (0.028)	-0.105* (0.028)	-0.078* (0.028)	-0.069** (0.028)	-0.091* (0.028)	-0.082* (0.028)	-0.175* (0.038)	-0.176* (0.038)	-0.175* (0.038)	-0.177* (0.038)
constant	-1.795* (0.164)	-1.646* (0.164)	-1.765* (0.164)	-1.619* (0.164)	-2.206* (0.169)	-2.078* (0.169)	-2.201* (0.169)	-2.075* (0.169)	-2.427* (0.264)	-2.253* (0.265)	-2.604* (0.268)	-2.433* (0.269)
company fixed effects	no	no	no	no	yes	yes	yes	yes	yes	yes	yes	yes
year fixed effects	no	no	no	no	no	no	no	no	yes	yes	yes	yes
Observations	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389	12,389
R-squared	0.374	0.372	0.560	0.559	0.448	0.446	0.611	0.610	0.479	0.478	0.633	0.632

Table 14. The Effect of Consolidated Trading on Four Dow Securities After the Consolidated Initiates Trading

This table reports the results from the estimation of the following model:

$$SPREAD_{it} = \alpha_0 + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \beta_5 MVOL_{it} + \beta_6 CALL_t + \beta_7 SHARE_{it} + \beta_8 CONC_t + \varepsilon_{it}$$

where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 13. COMP is a dummy variable that takes on a value of one for all observations after the firm has entered the Dow Averages and the Consolidated initiates trading and the value of zero for the observations in the months after the security enters the Dow Averages but before the Consolidated initiates trading. The other variables are as defined as in Table 13. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A)	(B)	(C)	(D)
	dependent variable			
	natural log of absolute spread	natural log of absolute spread	natural log of relative spread	natural log of relative spread
natural log of individual security volume	-0.184* (0.021)	-0.172* (0.056)	-0.181* (0.021)	-0.174* (0.055)
natural log of individual security closing price	0.434* (0.093)	-0.444* (0.096)	-0.505* (0.081)	-0.490* (0.242)
natural log of individual security volatility	0.213* (0.037)	0.228* (0.043)	0.224* (0.036)	0.242* (0.041)
presence of Consolidated trading	-0.272* (0.105)	-0.254* (0.107)	-0.239* (0.101)	-0.222** (0.103)
natural log of NYSE total weekly volume		-0.023 (0.073)		-0.028 (0.073)
natural log of broker's call rate		0.199* (0.058)		0.196* (0.057)
natural log of security's share of total volume		-0.020 (0.637)		-0.017 (0.064)
natural log of concentration ratio		0.072 (0.160)		0.030 (0.158)
constant	-0.901** (0.433)	- 0.035 (1.139)	-1.189* (0.383)	-0.250 (1.128)
company fixed effects included	no	no	no	no
Observations	564	564	564	564
R-squared	0.216	0.233	0.428	0.440

Table 15. Long-Term Effects of Consolidated Trading on the NYSE and the End of The Consolidated

This table reports the results from the estimation of the following models:

$$SPREAD_{it} = \alpha + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta_3 STDEV_i + \beta_4 COMP_t + \varepsilon_{it}$$

$$SPREAD_{it} = \alpha_0 + \beta_1 VOL_{it} + \beta_2 CLOSE_{it} + \beta 3 STDEVi + \beta_4 COMP_t + \beta_5 MVOL_{it} + \beta_6 CALL_t + \beta_7 SHARE_{it} + \beta_8 CONC_t + \varepsilon_{it}$$

where SPREAD is either the natural log of the absolute or the relative spread as defined in Table 10. The *Post-Silkworth Resignation* takes on a value of one for all months after June 1923 and 0 otherwise. The other variables are as defined as in Table 10 but measured in natural logs. Robust standard errors are in parentheses. *** significant at 10%; ** significant at 5%; * significant at 1%.

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
	dependent variable							
independent variable	ln of absolute spread	ln of relative spread	ln of absolute spread	ln of relative spread	ln of absolute spread	ln of relative spread	ln of absolute spread	ln of relative spread
natural log of individual security volume	-0.249* (0.004)	-0.251* (0.004)	-0.201* (0.004)	-0.204* (0.004)	-0.172* (0.010)	-0.174* (0.010)	-0.127* (0.009)	-0.130* (0.010)
natural log of individual security closing price	0.287* (0.011)	-0.694* (0.012)	0.229* (0.015)	-0.732* (0.017)	0.270* (0.011)	-0.709* (0.012)	0.177* (0.015)	-0.780* (0.018)
natural log of individual security volatility	0.042* (0.010)	0.050* (0.010)			0.0394* (0.010)	0.047* (0.010)		
Post-Silkworth Resignation	0.112* (0.019)	0.111* (0.019)	0.062* (0.019)	0.060* (0.019)	0.051** (0.022)	0.051** (0.022)	0.001 (0.021)	0.004 (0.021)
natural log of NYSE total monthly volume					0.034* (0.013)	0.028** (0.013)	0.064* (0.014)	0.053* (0.014)
natural log of broker's call rate					0.115* (0.010)	0.116* (0.010)	0.092* (0.010)	0.093* (0.010)
natural log of security's share of total volume					-0.089* (0.010)	-0.089* (0.010)	-0.089* (0.010)	-0.089* (0.010)

natural log of concentration ratio					-0.087* (0.028)	-0.098* (0.028)	-0.062** (0.028)	-0.075* (0.028)
constant	-0.394* (0.046)	-0.444* (0.046)	-0.627* (0.062)	-0.774* (0.068)	-1.538* (0.175)	-1.510* (0.174)	-2.144* (0.178)	-2.134* (0.178)
Company Fixed Effects	no	no	yes	yes	no	no	yes	yes
Observations	12389	12389	12389	12389	12389	12389	12389	12389
R-squared	0.339	0.536	0.423	0.594	0.362	0.552	0.442	0.607