

*Chapter 1*

## **A COMPARISON OF NYSE AND REGIONAL TRADING (1993-2002)**

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### **ABSTRACT**

We conduct time series comparison of the number of trades, volume, and average trade size for NYSE-listed stocks that trade on the NYSE and the regional stock exchanges from 1993 through 2002 (we include NASDAQ as a regional exchange). We find that the percentage of volume that the NYSE executes is fairly constant over the ten-year time period. The Cincinnati, Pacific and Philadelphia Stock Exchanges lose a substantial percentage of the trading volume in the NYSE-listed securities, while NASDAQ substantially increases its percentage of trades in NYSE-listed securities. Daily trading activity on the exchanges is significantly related to market movements, interest rate changes and Mondays. Overall, there is a strong negative correlation for trading activity between the NYSE and regional exchanges.

### **INTRODUCTION**

Although regional stock exchanges are an important facet of our market system, few studies document regional activity. Furthermore, previous research focuses primarily on the competitiveness of the regionals' quoting behavior or on the impact of fragmentation on market quality. For example, Lee (1993), Blume and Goldstein (1997) and Bessembinder (2002) examine price competition between the NYSE and the regional stock exchanges and find that the NYSE has the best prices and executions. Arnold, Hersch, Hulheron, and Netter (1999) examine regional stock exchange mergers over time and the effect that these mergers

have on attracting order flow and narrowing bid-ask spreads. These studies all encompass short time spans— from one month to two years.

Chordia, Roll and Subrahmanyam (2001), examine NYSE liquidity and trading activity for 11 years (1988 through 1998) and find increases in trading activity over time and decreases trading costs (spreads, effective spreads). While, Chordia et al., only focus on NYSE trades, we expand upon their analysis and provide the first long-term study of competition between the NYSE and regional stock exchanges for volume in NYSE-listed stocks.<sup>1</sup> The time period of our study runs from 1993 to 2001. This extensive time series allows us to examine the impact of not only rule changes and tick size reductions on the overall competitiveness of the regional markets, but also, the performance of different market structures under a variety of market conditions. The 1990s were a particularly active period in the history of the regional markets characterized by one of the longest bull markets in history, the advent of alternative trading venues such as ECNs and the prevalence of preferenced order flows. There have been significant structural changes in the markets during our study time period. In 1997, the SEC enacted new order handling rules for NASDAQ, and the minimum tick size was reduced to \$1/16 from \$1/8 in 1997 and to 1¢ in early 2001.<sup>2</sup> We expect that the change in tick sizes will have significant impact on the ability of the regional exchanges to compete with the NYSE if the NYSE is the most cost efficient market place. Further, tick size reductions may significantly reduce the ability of the regional stock exchanges to purchase order flow from retail order takers. Our study also examines the day-to-day competition between the NYSE and regional exchanges.

Our results indicate that the time period studied is characterized by a steady increase in trades on the NYSE that comes largely at the expense of the regionals. Tick size reductions also serve to benefit the NYSE. On a daily basis, there are considerable fluctuations in the proportion of trading activity handled between the NYSE and regionals. These changes appear to be driven by the overall return on stocks, Mondays, and changes in key interest rates. Our study also raises several interesting questions regarding the role of retail traders in intra-day trading activity and the importance of market design during periods of declining prices.

## DATA

Data for this study are obtained from the New York Stock Exchange TAQ (trades and quotes) database. We examine data from January 1993 through December 2002 (ten years). We limit our examination to only NYSE common stocks (as designated in the “mast” file of the TAQ database). We adjust our sample each month and eliminate trades out of sequence, trades that occur before the open, and trades that occur after the close of regular NYSE trading hours. We aggregate the number of trades, the average trade size and total volume for

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<sup>1</sup> For the purpose of our study, NASDAQ is considered a regional stock exchange as it competes for off NYSE volume with the other regionals.

<sup>2</sup> See Barclay, Christie, Harris, Kandel, and Schultz (1999) for a discussion of these order handling rules and empirical findings of the resulting changes. Bessembinder (1999) examines the effect of the reduction in minimum tick size change to 16ths. For decimalization studies see: Bacidore, Battalio, and Jennings (2002) and Chakravarty, Wood, and Van Ness (2002).

each day. We supplement the data set with market data from CRSP and the dates of key macroeconomic data releases.

## RESULTS AND ANALYSIS

### Aggregating Trading Activity

Table 1 presents aggregate summary statistics for the sample. In panel A we report the number of firms in the sample. As the number of firms within our sample varies from year to year, we focus on percentages rather than absolute values. In panel B we report the percentage of the number of trades between the exchanges. These data are also presented monthly in Figure 1. The proportion of trades handled by the NYSE is relatively stable at around 60% until 2001 when the percentage increases to 73%, and then to 76% in 2002. Lee (1993), Blume and Goldstein (1997), and Bessembinder (2002) find that the NYSE generally quotes the best prices when compared with the regional stock exchanges. Therefore, our results are consistent with the previous work. We believe it would be interesting to know why the proportion of trades handled by the NYSE increases so dramatically after 2000. Most of these trades appear to come from NASDAQ where the percentage of trades drops from about 17% to 12.7% and 12.6% in 2001 and 2002 respectively. The percentage of trades executed on the remaining regional exchanges all decline during the last years of the sample. The percentage of trades on the Cincinnati, Pacific and Philadelphia exchanges all decline to less than 1% by 2002 from highs ranging from 3.9% (Philadelphia) to 7.7% (Chicago). The decline in these markets is dramatic but we should note that these exchanges may have substituted the loss in NYSE volume with activity from other sources.

Turning to panel C, which presents the percentage of volume for each exchange, we see that the NYSE is consistent over time in maintaining about 83 to 85% of the overall volume. Further, NASDAQ experiences an increase in volume from 6.4% in 1993 to 9.47% in 2002. The reason for this increase can be seen in panel D which presents trade sizes. From 2001 forward the average NASDAQ trade exceeds the average NYSE trade. Each of the remaining regional exchanges gets less than 5% of the volume during any year of the study. The Pacific and Philadelphia stock exchanges also lose noticeable market share in terms of volume. Monthly volume data is also presented in Figure 2, while monthly trade sizes are presented in Figure 3.

A possible explanation for the observed declines in regional market share maybe an overall decline in retail order flow, which would manifest itself in a decline in the smaller trade sizes on the regionals. This decline in retail order flow may be due, in part, to the overall market decline from April 2000, and the impact of tick size reductions, which served to reduce the ability of regional market makers to purchase order flow from retail brokers.

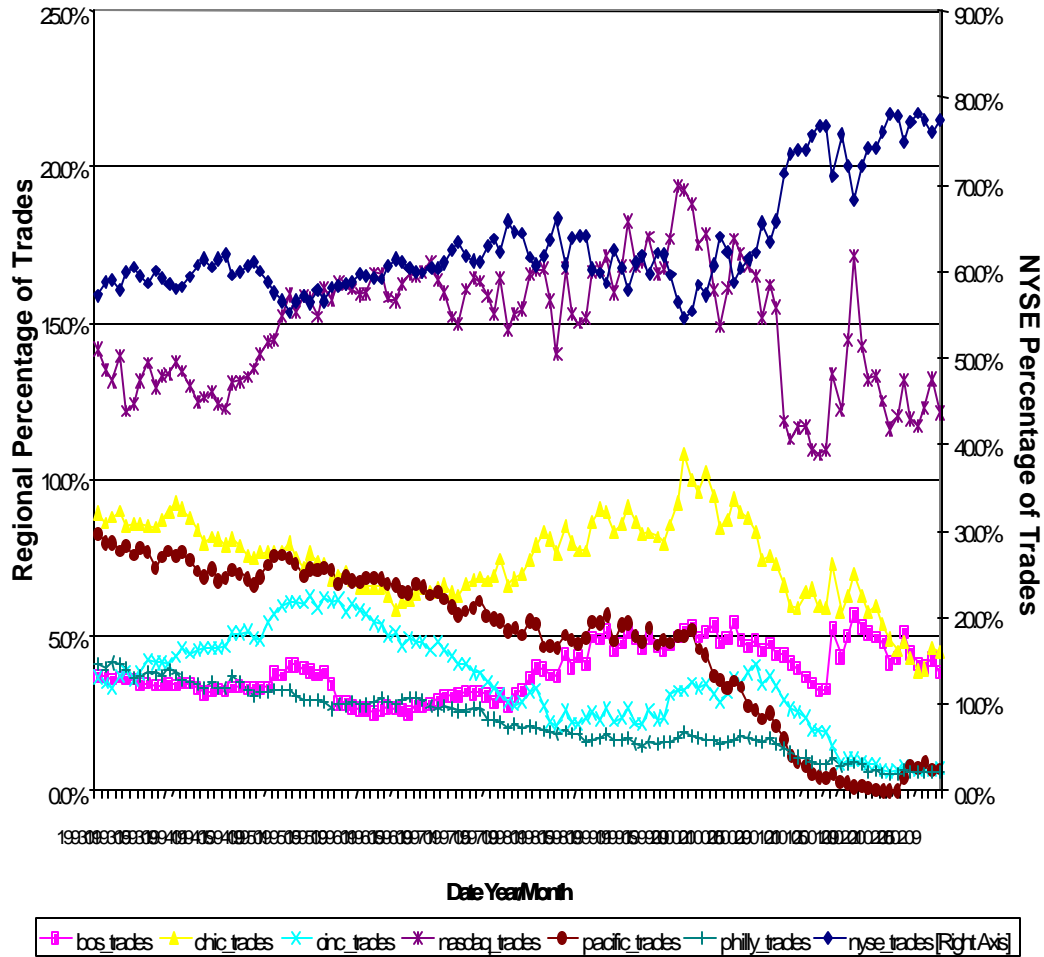


Figure 1. Percentage of Trades on NYSE and Regionals.

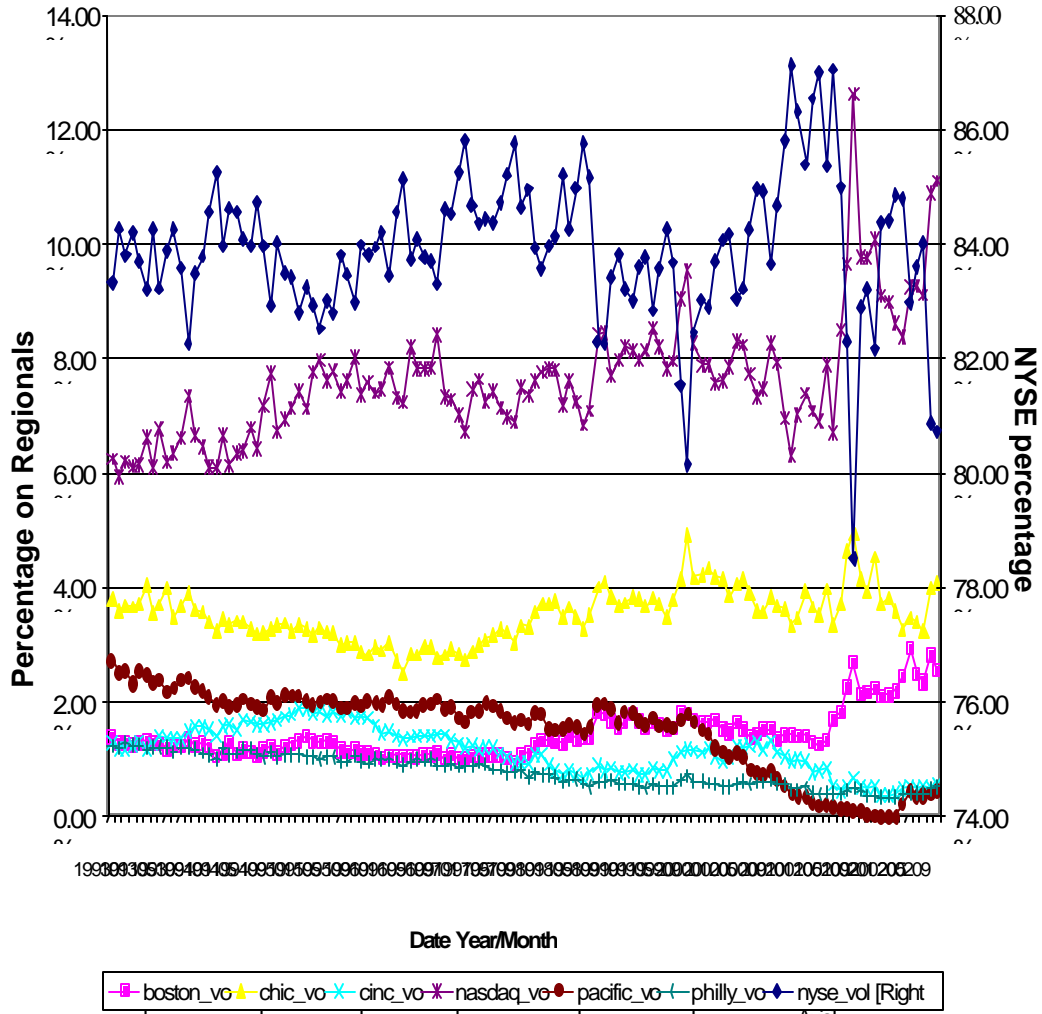


Figure 2. Percentage of Volume of NYSE.

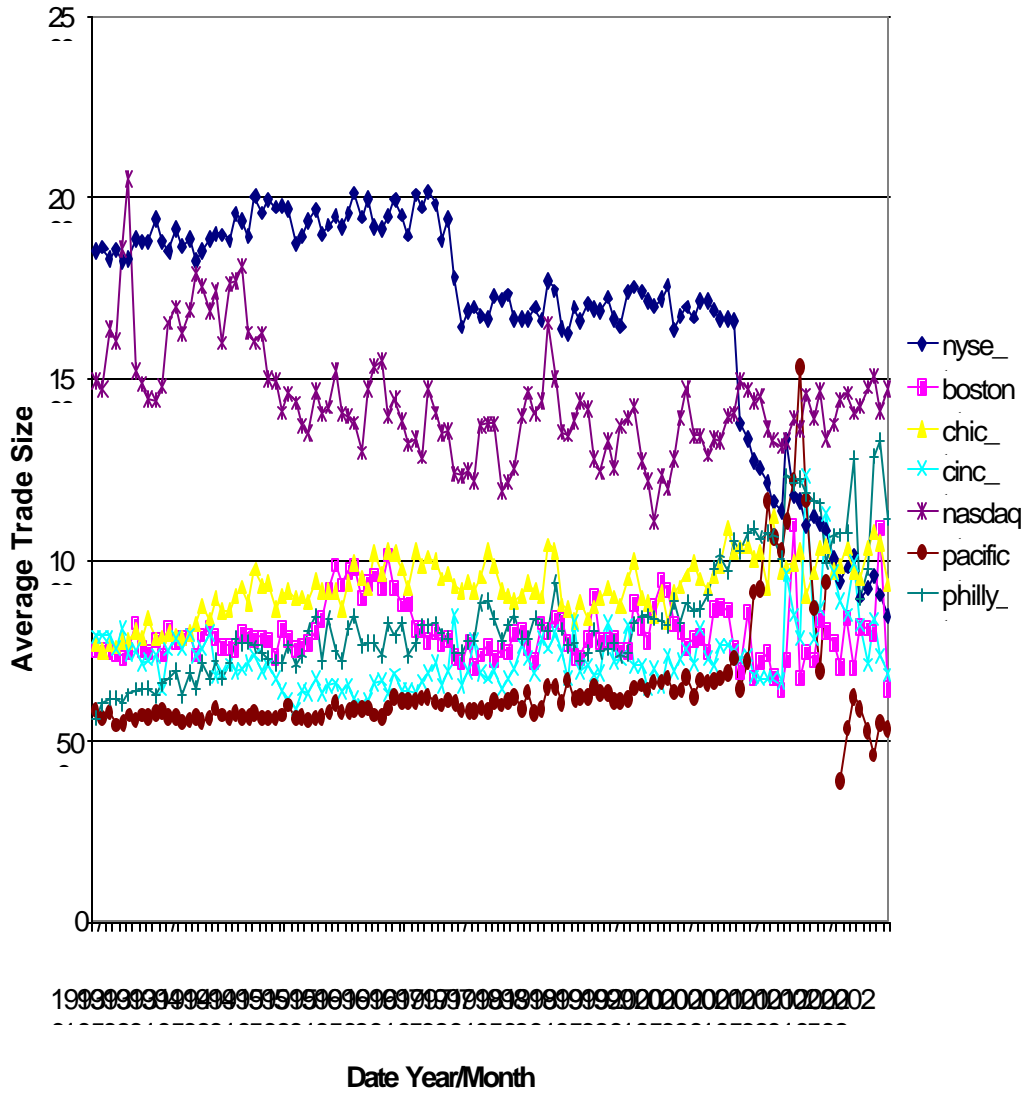


Figure 3. Trade Size on NYSE and Regionals.

**Table 1. Summary Statistics of Trades, Volume and Trade Size for NYSE and Regional Stock Exchanges from 1993 to 2002**

<b>Exchange</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
<b>Panel A: General Statistics</b>										
Number of Firms	2362	2563	2686	2842	3035	3092	3046	2931	2755	2745
Average Price	27.05	25.84	25.49	26.55	28.83	27.75	25.11	24.38	23.74	25.31
<b>Panel B: Percentage of the Number of Trades</b>										
NYSE	58.92%	60.37%	57.30%	59.97%	62.52%	62.54%	59.49%	60.69%	72.91%	76.27%
Boston	3.55%	3.32%	3.61%	2.66%	3.07%	4.12%	4.85%	4.97%	4.25%	4.50%
Chicago	8.75%	8.10%	7.38%	6.39%	6.75%	8.03%	8.80%	8.93%	9.37%	4.81%
Cincinnati	3.85%	4.76%	5.97%	5.18%	3.69%	2.53%	2.62%	3.46%	1.95%	0.76%
NASDAQ	13.32%	13.03%	15.59%	16.31%	15.79%	15.91%	17.56%	16.80%	12.72%	12.59%
Pacific	7.74%	7.03%	7.17%	6.62%	5.73%	5.02%	5.06%	3.51%	0.75%	0.44%
Philadelphia	3.87%	3.40%	2.97%	2.86%	2.45%	1.85%	1.63%	1.65%	1.04%	0.63%
<b>Panel C: Percentage of Volume</b>										
NYSE	83.65%	84.14%	83.21%	83.96%	84.85%	84.23%	82.98%	83.70%	84.99%	83.31%
Boston	1.28%	1.18%	1.26%	1.08%	1.05%	1.41%	1.66%	1.57%	1.64%	2.39%
Chicago	3.73%	3.36%	3.21%	2.85%	3.04%	3.63%	3.90%	4.00%	3.83%	3.73%
Cincinnati	1.30%	1.58%	1.80%	1.49%	1.17%	0.84%	0.88%	1.17%	0.81%	0.49%
NASDAQ	6.40%	6.59%	7.47%	7.69%	7.22%	7.58%	8.30%	7.86%	7.97%	9.47%
Pacific	2.42%	2.03%	2.02%	1.96%	1.81%	1.65%	1.70%	1.11%	0.29%	0.20%
Philadelphia	1.22%	1.12%	1.04%	0.97%	0.86%	0.64%	0.58%	0.58%	0.47%	0.41%
<b>Panel D: Average Trade Size</b>										
NYSE	1,863.65	1,890.79	1,945.94	1,949.09	1,824.77	1,691.22	1,701.58	1,692.42	1,260.47	978.17
Boston	760.92	780.46	791.99	935.03	765.55	780.25	789.22	837.72	749.06	792.08
Chicago	782.98	851.58	913.35	956.25	964.85	926.58	892.04	933.71	1,002.87	1,000.21
Cincinnati	746.29	734.42	656.42	640.61	697.72	717.78	723.77	729.61	755.50	849.99
NASDAQ	1,582.97	1,710.50	1,456.69	1,424.14	1,319.92	1,380.67	1,333.04	1,307.06	1,399.22	1,429.34
Pacific	569.87	567.85	571.25	594.00	600.56	617.68	630.50	660.46	915.51	565.68
Philadelphia	627.39	707.94	755.97	778.51	799.46	817.40	776.55	885.42	1,105.09	1,118.97

**Note:** This table shows the number of firms and average price for each year (1993 through 2002) for the sample of NYSE listed stocks (panel A). Panel B the percentage of the number of trades that occurs on each of the exchanges that trade NYSE listed stocks (NYSE, Boston, Chicago, Cincinnati, NASDAQ, Pacific, and the Philadelphia Stock Exchanges). Panel C shows the percentage of volume that each exchange receives for each of the nine years in the sample. Panel D shows the average size of a trade that occurs on each of the exchanges that trade NYSE listed stocks from 1993 through 2002.

**Table 2. The Number and Percentage of Firms Trading on Each Exchange**

<b>Exchange</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
<b>Panel A: Number of firms with trades on each Exchange</b>										
NYSE	2362	2563	2686	2842	3035	3092	3046	2931	2755	2745
Boston	1697	1874	1923	1988	1942	1795	1676	1600	1644	1342
Chicago	2149	2345	2499	2634	2800	2879	2879	2754	2541	2434
Cincinnati	666	651	688	620	682	599	757	915	746	643
NASDAQ	2341	2553	2679	2838	3029	3090	3044	2930	2755	2722
Pacific	1337	1407	1620	2105	2321	2368	2345	2253	1783	2117
Philadelphia	1971	2213	2338	2441	2573	2545	2242	2033	1710	1504
<b>Panel B: Percentage of Firms trading on each Exchange</b>										
NYSE	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Boston	71.85%	73.12%	71.59%	69.95%	63.99%	58.05%	55.02%	54.59%	59.67%	48.89%
Chicago	90.98%	91.49%	93.04%	92.68%	92.26%	93.11%	94.52%	93.96%	92.23%	88.67%
Cincinnati	28.20%	25.40%	25.61%	21.82%	22.47%	19.37%	24.85%	31.22%	27.08%	23.42%
NASDAQ	99.11%	99.61%	99.74%	99.86%	99.80%	99.94%	99.93%	99.97%	100.00%	99.16%
Pacific	56.60%	54.90%	60.31%	74.07%	76.47%	76.58%	76.99%	76.87%	64.72%	77.12%
Philadelphia	83.45%	86.34%	87.04%	85.89%	84.78%	82.31%	73.60%	69.36%	62.07%	54.79%
Exchange	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
<b>Panel C: Percentage of Firms that Trade on Each Exchange or More</b>										
1 Exchange	0.85%	0.23%	0.19%	0.11%	0.20%	0.10%	0.20%	0.03%	0.07%	0.73%
2 Exchanges	4.36%	3.59%	2.76%	2.85%	2.31%	2.49%	2.99%	3.38%	5.19%	6.16%
3 Exchanges	9.35%	8.86%	8.45%	8.06%	8.96%	9.73%	12.11%	13.10%	16.62%	14.43%
4 Exchanges	14.98%	16.15%	15.19%	13.02%	13.90%	14.91%	14.97%	15.22%	15.90%	20.15%
5 Exchanges	17.10%	18.92%	19.02%	15.02%	16.57%	19.79%	20.06%	18.80%	16.84%	18.18%
6 Exchanges	26.62%	28.29%	30.34%	39.76%	36.80%	34.54%	26.07%	21.29%	20.22%	18.29%
All 7 Exchanges	26.75%	23.96%	24.05%	21.18%	21.25%	18.43%	23.60%	28.18%	25.15%	22.08%

**Note:** This table shows the number of NYSE listed securities. Panel A shows the number of firms that trades on each of the exchange (NYSE, Boston, Chicago, Cincinnati, NASDAQ, Pacific, and Philadelphia Stock Exchanges). Panel B shows the percentage of firms that have trades on each of these exchanges.

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## Numbers of Firms on Exchanges

Table 2 presents the number of firms trading on the various exchanges. As can be seen from the aggregate numbers (panel A of table 2) and the percentage of NYSE-listed firms (panel B of table 2) NASDAQ is the most dominate of the regional exchanges in terms of the number and percentage of NYSE-listed securities traded. The Chicago Stock Exchange maintains trading around 90% of the NYSE-listed securities over the entire ten year time period. The Cincinnati Stock Exchange hovers around twenty percent. The Boston and Philadelphia stock exchanges show a dramatic decline in trading NYSE-listed securities, while the Pacific Stock Exchange shows an increase over the ten year time period. Panel C presents the percentage of stocks that trade on one or more exchanges. In all years, less than 1% trade only on one exchange, which by construction must be the NYSE. Therefore, virtually all NYSE stocks can be traded in venues outside of the NYSE – despite the evidence of the decline in the importance of the other exchanges for NYSE stocks during our sample time period.

## Correlations between Exchanges

Table 3 examines the correlations between the percentage of trades on the NYSE and regionals (panel A) and the percentage of volume on the NYSE and regionals (panel B). First, looking at the percentage of trades; with the exception of Boston, all of the regionals have a strong negative correlation with the NYSE. Looking at the percentage of volume in panel B we see that the negative relation is consistent across all the regionals, although the magnitude of the correlation varies substantially with NASDAQ having the greatest negative correlation and Cincinnati and Philadelphia having the smallest. The correlations between the regionals are more mixed with NASDAQ having a positive correlation with Boston and Chicago and a negative correlation with the Pacific and Philadelphia exchanges.

The striking result of table 3 is that there is strong evidence of volume going between the regionals and the NYSE. What is not clear is what causes this movement. We seek to examine this issue further in the following section.

**Table 3. Spearman Correlations of Trades and Volumes  
for the NYSE and Regional Exchanges**

	NYSE	Boston	Chicago	Cincinnati	NASDAQ	Pacific	Philadelphia
<b>Panel A: Number of Trades</b>							
NYSE	1.0000						
Boston	0.0742 <sup>†</sup>	1.0000					
Chicago	-0.7368 <sup>†</sup>	0.3048 <sup>†</sup>	1.0000				
Cincinnati	-0.7572 <sup>†</sup>	-0.4768 <sup>†</sup>	0.2877 <sup>†</sup>	1.0000			
NASDAQ	-0.6544 <sup>†</sup>	0.2524 <sup>†</sup>	0.4405 <sup>†</sup>	0.2727 <sup>†</sup>	1.0000		
Pacific	-0.8632 <sup>†</sup>	-0.4495 <sup>†</sup>	0.4933 <sup>†</sup>	0.7993 <sup>†</sup>	0.2934 <sup>†</sup>	1.0000	
Philadelphia	-0.7299 <sup>†</sup>	-0.5135 <sup>†</sup>	0.4097 <sup>†</sup>	0.7860 <sup>†</sup>	0.0468 <sup>*</sup>	0.9136 <sup>†</sup>	1.0000
<b>Panel B: Volume</b>							
NYSE	1.0000						
Boston	-0.4447 <sup>†</sup>	1.0000					
Chicago	-0.5831 <sup>†</sup>	0.4852 <sup>†</sup>	1.0000				
Cincinnati	-0.1698 <sup>†</sup>	-0.5598 <sup>†</sup>	-0.2805 <sup>†</sup>	1.0000			
NASDAQ	-0.7114 <sup>†</sup>	0.6665 <sup>†</sup>	0.4235 <sup>†</sup>	-0.3526 <sup>†</sup>	1.0000		
Pacific	-0.2094 <sup>†</sup>	-0.5682 <sup>†</sup>	-0.2103 <sup>†</sup>	0.6869 <sup>†</sup>	-0.4197 <sup>†</sup>	1.0000	
Philadelphia	-0.1620 <sup>†</sup>	-0.5356 <sup>†</sup>	-0.2469 <sup>†</sup>	0.7636 <sup>†</sup>	-0.4342 <sup>†</sup>	0.8030 <sup>†</sup>	1.0000

\* Statistically Significant at the 5% level.

† Statistically Significant at the 1% level.

**Note:** This table examines the correlations of NYSE listed stocks and the exchanges in which they trade (NYSE, Boston, Chicago, Cincinnati, NASDAQ, Pacific, and the Philadelphia Stock Exchange). Panel A shows the correlation of the percentage of trades between each exchange. Panel B shows the correlation of the percentage volume between each exchange.

## Determinants of Changes in Trading and Volume between the NYSE and Regionals

In order to examine factors that might determine the volume on the NYSE versus the regional exchanges, we employ the methodology of Chordia, Roll and Subrahmanyam (2001) who examine the impact of market wide and macroeconomic factors on market liquidity and trading activity. Chordia et al. find that the overall market return, the day of the week, holidays, and the change in the level of key interest rates significantly affect traded and effective spreads and overall market activity, however, their paper examines only NYSE stocks traded on the NYSE. We modify their regression model as follows:

$$\begin{aligned}
 [\text{Dependent}_{it}] = & b_0 + b_1 \text{MKTUP}_{it} + b_2 \text{MKTDN}_{it} + b_3 \text{MA5MKTUP}_{it} \\
 & + b_4 \text{MA5MKTDN}_{it} + b_5 \text{MA5|MKT}_{it}| + b_{6-9} \text{Day of the week Dummies}_t \\
 & + b_{10} \text{Holiday}_t + b_{11} \text{Short Rate}_t + b_{14} \text{Short Rate}_t + b_{15} \text{Term Spread}_t \\
 & + b_{16} \text{Quality Spread}_t + b_{17} \text{GDP}(1-2)_t + b_{18} \text{GDP}(0)_t + b_{19} \text{UNP}(1-2)_t \\
 & + b_{20} \text{UNP}(0)_t + b_{21} \text{CPI}(1-2)_t + b_{22} \text{CPI}(0)_t + \epsilon_{it}
 \end{aligned}$$

where  $\text{Dependent}_{it}$  is either the daily change in percentage volume or percentage number of trades. Our goal is to examine what market wide factors might impact the movement of trades or volume to and from the NYSE. The independent variables are those used by Chordia et al.

(2001) and are:  $MKTUP_t$ , the CRSP equally weighted daily return if positive and zero otherwise;  $MKTDN_t$ , the CRSP equally-weighted return if negative and zero otherwise;  $MA5MKTUP_{it}$  is the CRSP index return for the past five days if it is positive, 0 otherwise;  $MA5MKTDN_{it}$  is the CRSP index return for the past five days if it is negative, 0 otherwise;  $MA5|MKT_{it}|$  is the average of the absolute value of the past five day's CRSP index returns; days of the week dummies (Thursday is excluded); a holiday dummy that takes the value of 1 if the preceding day is a holiday;  $Short\ Rate_t$ , the change in the daily Federal Funds rate;  $Term\ Spread_t$ , the change in the difference between the 10-year Treasury rate and the Fed Funds rate; and  $Quality\ Spread_t$ , the difference between the average yield on Moody's Baa rated corporate bonds and the 10-year Treasury rate;  $GDP(0)$  is 1 on the day of a GDP announcement, 0 otherwise;  $GDP(1-2)$  is 1 on the two days prior to a GDP announcement, 0 otherwise.  $UNP$  and  $CPI$  are defined as GDP for unemployment and consumer price index announcements, respectively.

In table 4 the dependent variable is the change in the in the percentage of trades on each exchange. We report the regression for the NYSE and each of the six regional exchanges. Because we are examining the change in percentage of trades across the exchanges, the coefficient estimates for each variable should sum to zero across the seven regression models. This allows us to see where net gains in percentage trades are offset by net losses.

Some striking results are evident. The coefficient on  $MKTUP$  is negative and significant for the NYSE but positive and significant on all the other exchanges. Conversely for  $MKTDN$ , the coefficient is positive for the NYSE but negative for the other exchanges. These results suggest that when the market moves up trades move from the NYSE to the regionals, but in a down market the trades move back to the NYSE. In a down market, immediacy of execution may be of greater priority to traders, and this evidence suggests that the NYSE is better able to meet that need.

For  $MA5MKTUP$ , which measures a five day run up, there is a weak positively significant effect for the NYSE, however for  $MA5MKTDN$ , there is a significant negative coefficient for the NYSE and a positive and significant coefficient for Chicago, although all the other exchanges have positive signs. The pattern emerging here is that when there is a negative market shock, at the margin, trades move to the NYSE, but if the negative market shock is sustained, trades return to the regionals.

Looking at the days of the week, we find that for the NYSE, Monday is negative and significant, while several of the regionals are positive and significant. This result is consistent with a larger volume of retail trades being executed on Monday (after retail investors do their analysis over the weekend). Such trades are usually routed through preferencing arrangements to regional exchanges. On Tuesday, the coefficient is positive and significant indicating a correction to a more normal distribution of trades for the rest of the week.

Changes in interest rates also impact the percentage of trades on the NYSE. An increase in the Short Rate (the Fed Funds rate) has a positive impact on the percentage of trades on the NYSE while having a negative impact for Chicago, Cincinnati, NASDAQ and Pacific. Given that increases in the Fed Funds rate are usually greeted negatively this result is related to the  $MKTDN$  result which also finds a percentage shift in trades to the NYSE in down markets. An increase in the term spread is also related to a move to the NYSE while a decline in the quality spread results in a move from the NYSE to the regionals (specifically Chicago, NASDAQ and Pacific).

**Table 4. Change in Percentage Number of Trades**

	<b>NYSE</b>	<b>Boston</b>	<b>Chicago</b>	<b>Cincinnati</b>	<b>NASDAQ</b>	<b>Pacific</b>	<b>Philadelphia</b>
Intercept	-0.0020 (1.53)	0.0001 (0.17)	0.0017 (4.28)*	-0.0003 (1.51)	0.0004 (0.58)	0.0002 (0.89)	-0.0001 (1.42)
MKT +	-1.1531 (11.35)*	0.1893 (7.55)*	0.2839 (8.83)*	0.1076 (6.77)*	0.4411 (8.14)*	0.0898 (4.50)*	0.0416 (5.07)*
MKT -	0.8016 (8.55)*	-0.1330 (5.75)*	-0.2056 (6.93)*	-0.0806 (5.50)*	-0.3092 (6.18)*	-0.0544 (2.95)*	-0.0188 (2.48)*
MA5MKT+	0.0745 (1.87)	-0.0109 (1.11)	-0.0199 (1.58)	-0.0089 (1.43)	-0.0211 (0.99)	-0.0076 (0.97)	-0.0063 (1.95)
MA5MKT-	-0.1274 (2.84)*	0.0172 (1.55)	0.0389 (2.74)*	0.0102 (1.45)	0.0428 (1.79)	0.0120 (1.37)	0.0063 (1.74)
MA5 MKT	0.7366 (4.78)*	-0.1071 (2.81)*	-0.1883 (3.86)*	-0.0616 (2.55)*	-0.3102 (3.77)*	-0.0553 (1.82)	-0.0142 (1.14)
Monday	-0.0032 (2.09)*	0.0004 (1.13)	0.0011 (2.28)*	0.0004 (1.72)	-0.0001 (0.08)	0.0010 (3.36)*	0.0003 (2.46)*
Tuesday	0.0091 (6.22)*	-0.0011 (2.96)*	-0.0053 (11.48)*	-0.0001 (0.47)	-0.0015 (1.90)	-0.0013 (4.61)*	0.0002 (1.72)
Wednesday	0.0017 (1.24)	0.0005 (1.51)	-0.0028 (6.47)*	0.0006 (2.58)*	0.0002 (0.24)	-0.0001 (0.44)	-0.0000 (0.20)
Thursday	0.0026 (1.91)	-0.0001 (0.25)	-0.0020 (4.65)*	0.0004 (1.69)	-0.0006 (0.83)	-0.0003 (1.30)	0.0001 (0.70)
Holiday	-0.0034 (1.79)	-0.0001 (0.28)	0.0035 (5.81)*	-0.0000 (0.06)	0.0001 (0.09)	0.0002 (0.49)	-0.0002 (1.23)
Short Rate	0.0669 (3.89)*	-0.0029 (0.69)	-0.0197 (3.62)*	-0.0058 (2.15)*	-0.0267 (2.91)*	-0.0100 (2.98)*	-0.0018 (1.28)
Term Spread	0.0073 (2.09)*	0.0009 (1.00)	-0.0036 (3.27)*	-0.0007 (1.20)	-0.0023 (1.24)	-0.0014 (1.99)*	-0.0002 (0.78)
Quality Spread	-0.0195 (4.14)*	0.0019 (1.66)	0.0057 (3.79)*	0.0010 (1.33)	0.0079 (3.16)*	0.0024 (2.62)*	0.0006 (1.55)
GDP(1-2)	0.0007 (0.51)	-0.0008 (2.22)*	0.0001 (0.25)	-0.0001 (0.31)	-0.0002 (0.30)	0.0002 (0.81)	0.0000 (0.09)
GDP (0)	0.0050 (2.63)*	-0.0009 (1.93)	-0.0004 (0.74)	-0.0006 (1.91)	-0.0021 (2.07)*	-0.0010 (2.61)*	-0.0000 (0.12)
UNP (1-2)	-0.0036 (1.75)	0.0004 (0.85)	0.0016 (2.42)*	0.0000 (0.13)	0.0014 (1.33)	-0.0000 (0.00)	0.0001 (0.62)
UNP (0)	-0.0013 (0.64)	-0.0001 (0.20)	-0.0010 (1.47)	0.0004 (1.22)	0.0019 (1.73)	0.0000 (0.10)	0.0001 (0.31)
CPI (1-2)	-0.0007 (0.39)	0.0002 (0.35)	0.0006 (1.05)	0.0001 (0.39)	0.0002 (0.18)	-0.0004 (1.02)	0.0000 (0.16)
CPI (0)	-0.0003 (0.16)	0.0003 (0.73)	-0.0007 (1.11)	0.0005 (1.67)	0.0001 (0.11)	-0.0001 (0.16)	0.0000 (0.50)
Adj. R <sup>2</sup>	0.1126	0.0475	0.1601	0.0290	0.0499	0.0426	0.0134

\* Statistically Significant at the 5% level.

**Note:** This table shows the daily change in the percentage of trades on each exchange regressed against the CRSP equally weighted daily returns, and dummy variables for each day of the week (Wednesday is omitted), a dummy variable for holidays, changes in various key interest rates and dummy variables indicating macroeconomic news announcements.

**Table 5. Change in Percentage Volume of Trades**

	NYSE	Boston	Chicago	Cincinnati	NASDAQ	Pacific	Philadelphia
Intercept	0.0020 (2.54)*	-0.0001 (0.38)	-0.0002 (0.81)	-0.0001 (1.03)	-0.0015 (3.08)*	0.0001 (1.06)	-0.0002 (2.56)*
MKT +	-0.1488 (2.33)*	0.0466 (4.01)*	0.0626 (2.55)*	0.0285 (3.65)*	-0.0063 (0.16)	0.0216 (2.23)*	-0.0042 (0.56)
MKT -	-0.1121 (1.90)	-0.0076 (0.71)	0.0097 (0.43)	-0.0137 (1.90)	0.1119 (3.07)*	-0.0010 (0.11)	0.0128 (1.87)
MA5MKT+	0.0342 (1.36)	-0.0065 (1.42)	-0.0094 (0.98)	-0.0015 (0.49)	-0.0104 (0.67)	-0.0041 (1.08)	-0.0022 (0.77)
MA5MKT-	0.0010 (0.03)	0.0044 (0.86)	0.0074 (0.68)	0.0007 (0.20)	-0.0169 (0.97)	0.0024 (0.55)	0.0011 (0.34)
MA5 MKT	0.0337 (0.35)	-0.0075 (0.43)	-0.0798 (0.53)	-0.0188 (1.59)	0.0209 (0.35)	-0.0152 (1.03)	0.0067 (0.60)
Monday	-0.0147 (15.26)*	0.0011 (6.35)*	0.0022 (6.03)*	0.0012 (10.17)*	0.0077 (13.04)*	0.0015 (10.18)*	0.0009 (8.29)*
Tuesday	0.0041 (4.46)*	-0.0009 (5.24)*	-0.0007 (2.08)*	-0.0007 (5.96)*	-0.0007 (1.25)	-0.0012 (8.69)*	0.0001 (0.85)
Wednesday	0.0001 (0.12)	0.0000 (0.04)	-0.0003 (0.85)	0.0001 (0.61)	0.0003 (0.49)	-0.0004 (2.79)*	0.0002 (2.09)*
Thursday	-0.0010 (1.11)	-0.0000 (0.23)	0.0001 (0.29)	-0.0001 (1.18)	0.0009 (1.72)	-0.0002 (1.23)	0.0003 (2.66)*
Holiday	-0.0042 (3.50)*	0.0006 (2.60)*	0.0010 (2.08)*	0.0005 (3.46)*	0.0015 (2.05)*	0.0006 (3.49)*	0.0000 (0.11)
Short Rate	0.0495 (4.57)*	-0.0032 (1.64)	-0.0125 (3.01)*	-0.0034 (2.54)*	-0.0250 (3.75)*	-0.0041 (2.50)*	-0.0013 (1.03)
Term Spread	0.0041 (1.84)	0.0000 (0.03)	-0.0008 (0.96)	-0.0002 (0.91)	-0.0025 (1.82)	-0.0004 (1.19)	-0.0001 (0.56)
Quality Spread	-0.0047 (1.57)	0.0004 (0.69)	0.0012 (1.06)	0.0003 (0.86)	0.0018 (0.98)	0.0008 (1.72)	0.0002 (0.59)
GDP(1-2)	-0.0011 (1.22)	-0.0001 (0.71)	0.0005 (1.47)	-0.0000 (0.37)	0.0007 (1.30)	0.0000 (0.24)	-0.0000 (0.06)
GDP (0)	0.0004 (0.33)	-0.00001 (0.49)	0.0005 (0.99)	-0.0000 (0.22)	-0.0005 (0.62)	-0.0002 (1.01)	-0.0001 (0.50)
UNP (1-2)	0.0013 (1.02)	-0.0001 (0.33)	-0.0004 (0.79)	-0.0004 (2.62)*	-0.0002 (0.26)	-0.0001 (0.57)	-0.0001 (0.80)
UNP (0)	-0.0026 (1.99)*	-0.0000 (0.02)	-0.0002 (0.41)	0.0002 (1.32)	0.0020 (2.50)*	0.0003 (1.52)	0.0003 (1.90)
CPI (1-2)	-0.0008 (0.67)	0.0004 (1.84)	0.0004 (0.81)	-0.0002 (1.30)	0.0004 (0.50)	-0.0000 (0.24)	-0.0001 (0.73)
CPI (0)	0.0011 (0.92)	0.0001 (0.46)	-0.0005 (1.06)	0.0003 (1.85)	-0.0007 (0.95)	-0.0001 (0.51)	-0.0002 (1.40)
Adj. R <sup>2</sup>	0.2014	0.0675	0.0439	0.1174	0.1373	0.1657	0.0402

\* Statistically Significant at the 5% level.

**Note:** This tables shows the daily change in the percentage of volume on each exchange regressed against the CRSP equally weighted daily returns, and dummy variables for each day of the week (Wednesday is omitted), a dummy variable for holidays, changes in various key interest rates and dummy variables indicating macroeconomic news announcements.

The remaining coefficients in the regressions in table 4 measure the impact of GDP and unemployment announcements. GDP(0) is positive and significant for the NYSE but negative and significant for NASDAQ and Pacific. The rest of the macroeconomic variables are largely insignificant.

In table 5 we re-run the regressions in table 4 using the change in the percentage of volume for each exchange. Again we find a negative relation for MKTUP for the NYSE, and significant positive coefficients for all exchanges except NASDAQ and Philadelphia. The MKTDN variable is also negative but weakly significant for NYSE and positive and significant with a coefficient of about the same size for NASDAQ. This result is somewhat puzzling compared to the table 4 regressions which finds trades move back to the NYSE in down markets.

We find the same result as in table 4 when we look at the effect of Mondays on the change in percentage volume – again there is a significant movement of volume away from the NYSE. The trading day that follows a holiday is also associated with movement of volume away from the NYSE. We find a positive coefficient on the change in the short rate variable for the NYSE, which is consistent with trades moving to the NYSE when interest rates increase, which is generally greeted with a negative market reaction. This variable may be picking up some of the effect that we saw in table 4 on the MKTDN variable.

Chordia, Roll and Subrahmanyam's (2001) study takes place in a bull market and they question whether their results would hold in a bear market. Tables 6 and 7 replicate tables 4 and 5, but using the time frame of March 11<sup>th</sup>, 2000<sup>3</sup> through December 2002. Table 6 presents the change in percentage trades regressions for the bear market. The results are broadly in line with those reported in table 4. Notably, the coefficient on the MKTDN variable is significantly negative and larger than in table 4 – perhaps indicating that the importance of trading on the NYSE on bad market days is more significant in a bear market than in a bull market. The Monday effect is no longer manifested in the trade regression during this time period, possibly in part due to the significant decline in retail order flow that followed the collapse of the technology bubble. Table 7 reports the results for the change in percentage volume regressions. In these regressions none of the market variables seem to impact the volume on the NYSE. We cannot rule out that this result is due to the lower power of our tests due to the smaller sample size. Counter to table 6, Mondays are negative and significant, and the short rate variable is positive and significant for the NYSE.

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<sup>3</sup> March 11<sup>th</sup> 2000 was the peak of the NASDAQ index, hence we use this point as the beginning of the bear market.

**Table 6. Change in Percentage Number of Trades– Bear Market  
(March 11<sup>th</sup> 2000 forward)**

	NYSE	Boston	Chicago	Cincinnati	NASDAQ	Pacific	Philadelphia
Intercept	0.0012 (0.41)	0.0001 (0.07)	0.0010 (1.28)	-0.0001 (0.27)	-0.0014 (0.97)	-0.0004 (1.53)	-0.0004 (2.65)*
MKT +	-1.2269 (7.74)*	0.2616 (5.44)*	0.3099 (7.65)*	0.0982 (5.03)*	0.4894 (6.23)*	0.0368 (2.97)*	0.0310 (4.18)*
MKT –	1.2374 (7.95)*	-0.3007 (6.37)*	-0.2771 (6.97)*	-0.1407 (7.35)*	-0.4445 (5.77)*	-0.0505 (4.16)*	-0.0238 (3.27)*
MA5MKT+	0.0799 (1.24)	-0.0209 (1.07)	-0.0255 (1.55)	-0.0025 (0.32)	-0.0222 (0.70)	-0.0030 (0.59)	-0.0058 (1.93)
MA5MKT-	-0.1374 (2.06)*	0.0371 (1.83)	0.0477 (2.79)*	0.0065 (0.80)	0.0344 (1.04)	0.0047 (0.90)	0.0069 (2.22)*
MA5 MKT	0.8898 (3.52)*	-0.1967 (2.57)*	-0.1954 (3.02)*	-0.0889 (2.86)*	-0.3788 (3.02)*	-0.0166 (0.84)	-0.0134 (1.13)
Monday	-0.0017 (0.52)	0.0007 (0.68)	0.0011 (1.34)	-0.0004 (0.98)	-0.0003 (0.21)	0.0003 (1.12)	0.0004 (2.28)*
Tuesday	0.0028 (0.85)	-0.0016 (1.58)	-0.0041 (4.93)*	-0.0003 (0.65)	0.0022 (1.35)	0.0004 (1.68)	0.0005 (3.52)*
Wednesday	-0.0051 (1.71)	0.0017 (1.89)	-0.0018 (2.31)*	0.0005 (1.38)	0.0037 (2.47)*	0.0005 (2.28)*	0.0005 (3.33)*
Thursday	-0.0012 (0.39)	0.0006 (0.69)	-0.0012 (1.51)	0.0001 (0.17)	0.0012 (0.76)	0.0001 (0.31)	0.0005 (3.29)*
Holiday	0.0010 (0.24)	-0.0013 (1.06)	0.0024 (2.33)*	-0.0005 (0.91)	-0.0008 (0.40)	-0.0004 (1.35)	-0.0004 (2.11)*
Short Rate	0.0313 (1.04)	-0.0091 (1.00)	-0.0130 (1.71)	-0.0035 (0.94)	-0.0062 (0.42)	0.0001 (0.03)	0.0005 (0.33)
Term Spread	-0.0149 (1.80)	0.0038 (1.53)	-0.0014 (0.64)	0.0024 (2.36)*	0.0078 (1.90)	0.0014 (2.12)*	0.0009 (2.23)*
Quality Spread	0.0048 (0.53)	-0.0013 (0.47)	0.0031 (1.34)	-0.0022 (1.94)	-0.0032 (0.72)	-0.0006 (0.88)	-0.0006 (1.51)
GDP(1-2)	0.0058 (1.88)	-0.0024 (2.53)*	-0.0006 (0.77)	-0.0004 (1.01)	-0.0020 (1.29)	-0.0004 (1.49)	-0.0001 (0.88)
GDP (0)	0.0046 (1.12)	-0.0014 (1.09)	-0.0004 (0.40)	-0.0003 (0.65)	-0.0022 (1.09)	-0.0003 (0.86)	-0.0000 (0.09)
UNP (1-2)	-0.0010 (0.23)	0.0008 (0.56)	-0.0002 (0.21)	-0.0001 (0.17)	0.0005 (0.23)	-0.0001 (0.26)	0.0002 (0.80)
UNP (0)	-0.0035 (0.76)	-0.0006 (0.46)	0.0011 (0.91)	0.0004 (0.79)	0.0024 (1.05)	-0.0000 (0.01)	0.0002 (1.09)
CPI (1-2)	0.0009 (0.22)	-0.0001 (0.08)	-0.0002 (0.22)	0.0004 (0.74)	-0.0003 (0.16)	-0.0008 (2.40)*	0.0001 (0.69)
CPI (0)	0.0038 (0.93)	-0.0009 (0.71)	-0.0009 (0.86)	-0.0002 (0.50)	-0.0012 (0.59)	-0.0004 (1.26)	-0.0002 (0.89)
Adj. R <sup>2</sup>	0.1713	0.1214	0.1797	0.1254	0.1217	0.0596	0.0767

\* Statistically Significant at the 5% level.

**Note:** This tables shows the daily change in the percentage of trades on each exchange regressed against the CRSP equally weighted daily returns, and dummy variables for each day of the week (Wednesday is omitted), a dummy variable for holidays, changes in various key interest rates and dummy variables indicating macroeconomic news announcements.

**Table 7. Change in Percentage Volume– Bear Market  
(March 11<sup>th</sup> 2000 Forward)**

	NYSE	Boston	Chicago	Cincinnati	NASDAQ	Pacific	Philadelphia
Intercept	0.0033 (1.99)*	-0.0001 (0.37)	0.0000 (0.03)	-0.0001 (0.51)	-0.0029 (2.74)*	-0.0000 (0.34)	-0.0002 (1.34)
MKT +	-0.0536 (0.62)	0.0586 (2.97)*	0.0496 (1.56)	0.0145 (1.81)	-0.0721 (1.31)	0.0000 (0.00)	0.0031 (0.47)
MKT –	0.0726 (0.85)	-0.0501 (2.59)*	-0.0181 (0.58)	-0.0271 (3.45)*	0.0247 (0.46)	-0.0050 (0.93)	0.0031 (0.48)
MA5MKT+	-0.0105 (0.30)	-0.0094 (1.17)	0.0018 (0.14)	-0.0008 (0.23)	0.0216 (0.96)	-0.0005 (0.20)	-0.0023 (0.87)
MA5MKT-	0.0182 (0.50)	0.0100 (1.21)	0.0046 (0.34)	-0.0012 (0.35)	-0.0319 (1.37)	-0.0010 (0.44)	0.0014 (0.48)
MA5 MKT	0.1033 (0.75)	-0.0352 (1.12)	-0.0480 (0.95)	-0.0210 (1.64)	-0.0034 (0.04)	0.0027 (0.31)	0.0016 (0.15)
Monday	-0.0147 (8.15)*	0.0019 (4.67)*	0.0027 (4.05)*	0.0009 (5.19)*	0.0084 (7.26)*	0.0004 (3.86)*	0.0005 (3.38)*
Tuesday	0.0005 (0.26)	-0.0013 (3.29)*	-0.0007 (1.02)	-0.0006 (3.63)*	0.0021 (1.88)	-0.0002 (1.43)	0.0002 (1.25)
Wednesday	-0.0001 (0.05)	0.0006 (1.47)	-0.0012 (2.02)*	-0.0001 (0.41)	0.0008 (0.76)	-0.0002 (1.60)	0.0002 (1.44)
Thursday	-0.0030 (1.77)	0.0003 (0.85)	-0.0003 (0.42)	-0.0000 (0.12)	0.0029 (2.71)*	-0.0002 (1.55)	0.0002 (1.43)
Holiday	-0.0040 (1.79)	0.0010 (1.95)	0.0011 (1.36)	0.0006 (3.06)*	0.0012 (0.84)	0.0001 (0.92)	-0.0001 (0.36)
Short Rate	0.0572 (3.50)*	-0.0075 (2.01)*	-0.0189 (3.16)*	-0.0042 (2.77)*	-0.0239 (2.30)*	-0.0009 (0.89)	-0.0017 (1.39)
Term Spread	-0.0061 (1.36)	0.0010 (0.96)	-0.0004 (0.25)	0.0008 (1.96)*	0.0037 (1.28)	0.0006 (2.12)*	0.0005 (1.33)
Quality Spread	0.0055 (1.13)	-0.0005 (0.43)	0.0009 (0.51)	-0.0007 (1.57)	-0.0043 (1.35)	-0.0005 (1.48)	-0.0006 (1.49)
GDP(1-2)	0.0003 (0.20)	-0.0006 (1.58)	0.0002 (0.34)	-0.0001 (0.83)	0.0004 (0.36)	-0.0001 (0.69)	-0.0001 (1.03)
GDP (0)	0.0002 (0.11)	-0.0003 (0.51)	0.0004 (0.43)	0.0004 (1.96)*	-0.0009 (0.64)	0.0000 (0.17)	0.0001 (0.85)
UNP (1-2)	0.0044 (1.82)	-0.0003 (0.50)	-0.0015 (1.71)	-0.0003 (1.42)	-0.0022 (1.41)	-0.0001 (0.83)	0.0000 (0.00)
UNP (0)	-0.0030 (1.21)	0.0000 (0.06)	0.0010 (1.04)	0.0004 (1.53)	0.0016 (1.00)	-0.0000 (0.08)	0.0001 (0.51)
CPI (1-2)	-0.0016 (0.73)	0.0009 (1.85)	0.0002 (0.30)	0.0003 (1.28)	0.0001 (0.06)	-0.0001 (0.37)	0.0001 (0.81)
CPI (0)	0.0031 (1.40)	-0.0003 (0.63)	-0.0009 (1.08)	-0.0001 (0.64)	-0.0015 (1.08)	-0.0002 (1.75)	-0.0000 (0.05)
Adj. R <sup>2</sup>	0.1727	0.1209	0.0785	0.1573	0.1134	0.0744	0.0158

\* Statistically Significant at the 5% level.

**Note:** This tables shows the daily change in the percentage of volume on each exchange regressed against the CRSP equally weighted daily returns, and dummy variables for each day of the week (Wednesday is omitted), a dummy variable for holidays, changes in various key interest rates and dummy variables indicating macroeconomic news announcements.

Overall the results from tables 4 through 7 indicate that market conditions, in particular, result in significant trade and volume movements to and from the NYSE and regional exchanges. The impact of retail order flow also has some impact on the volume of the exchanges, particularly on Mondays.

### **The Impact of Tick Size Reductions**

Two tick size changes occur during our analysis period– from \$1/8 to \$1/16 and from \$1/16 to decimals. Numerous studies examine the impact of these changes but largely ignore the regional exchanges. In this section, we examine the impact of tick size changes on the share of volume between the exchanges. Such changes may have significant impacts on the trades and volume of different exchanges. In particular, if the NYSE has a cost advantage over the regionals, the reduction in tick size may result in the NYSE being able to more cost effectively execute trades. Furthermore, if regional exchanges obtain much of their order flow through preferencing arrangements, their ability to pay for such order flow will be reduced following tick size reductions.

Table 8 examines changes in trading (panel A), volume (panel B), and trade size (panel C) surrounding the minimum tick size changes from \$1/8 to \$1/16 and from \$1/16 to decimals. We find consistent results for the 30 trading days before and after the two minimum tick size changes for the percentage of trading activity (panel A of table 8). The percentage of trades executed by the NYSE significantly increases, while the other exchanges that trade NYSE-listed securities show significant declines in the percentage of trades (two exceptions are: the Pacific Stock Exchange for the change to 16ths, and the Boston Stock Exchange in the change to decimals).

We find statistically significant declines in the percentage of volume accompanying the change to \$1/16 for the Cincinnati, NASDAQ and Philadelphia Stock Exchanges (panel B of table 8). The NYSE shows a significant increase in volume with the change to decimals and all other exchanges show a decline in the percentage of volume (Note that the Boston and Cincinnati Stock Exchanges' declines are not statistically significant).

Changes in the average size of trades accompanying the minimum tick size changes show mixed results (panel C of table 8). For both minimum tick size changes, the NYSE shows a statistically significant decline in the average trade size. But, the Cincinnati Stock Exchange shows a statistically significant increase in the average trade size following the change to \$1/16. Other changes in trade size following the two minimum tick size changes are either as expected (decreases) or are not statistically significant. The impact of tick size reductions appears to primarily benefit the NYSE at the expense of the regional exchanges as is evidenced by a consistent movement of volume and trades from the regionals to the NYSE.

**Table 8. The Impact of Tick Size Reductions on Trading Activity Between Exchanges**

	16ths				Decimals			
	Before	After	Diff	T-Stat	Before	After	Diff	T-Stat
<b>Panel A: % of the Total Number of Trades</b>								
NYSE	60.07	61.87	0.18	3.41 <sup>†</sup>	64.58	71.39	6.81	8.42 <sup>†</sup>
Boston	3.29	3.14	-0.15	2.74 <sup>†</sup>	4.52	4.20	-0.32	1.27
Chicago	6.92	6.75	-0.17	1.75*	7.49	6.58	-0.91	4.98 <sup>†</sup>
Cincinnati	4.14	3.61	-0.53	5.67 <sup>†</sup>	3.60	2.88	-0.72	6.70 <sup>†</sup>
NASDAQ	16.80	16.08	-0.72	2.69 <sup>†</sup>	15.92	12.06	-3.86	10.81 <sup>†</sup>
Pacific	6.03	5.97	-0.06	0.64	2.30	1.55	-0.75	8.57 <sup>†</sup>
Philadelphia	2.74	2.59	-0.15	3.69 <sup>†</sup>	1.59	1.34	-0.25	6.16 <sup>†</sup>
<b>Panel B: % of Volume</b>								
NYSE	84.07	84.44	0.37	1.35	83.93	85.91	1.98	4.57 <sup>†</sup>
Boston	1.08	1.08	0.00	0.10	1.44	1.42	-0.02	0.24
Chicago	2.99	3.12	0.13	1.63	3.80	3.64	-0.16	1.45
Cincinnati	1.23	1.17	-0.06	2.51 <sup>†</sup>	1.24	1.05	-0.19	3.51 <sup>†</sup>
NASDAQ	7.76	7.37	-0.39	2.46 <sup>†</sup>	8.25	6.92	-1.33	5.80 <sup>†</sup>
Pacific	1.89	1.96	0.07	1.41	0.74	0.51	-0.23	6.42 <sup>†</sup>
Philadelphia	0.95	0.88	-0.07	2.40 <sup>†</sup>	0.60	0.54	-0.06	2.60 <sup>†</sup>
<b>Panel C: Average Trade Size</b>								
NYSE	1933.42	1779.39	-154.03	4.68 <sup>†</sup>	1674.98	1370.10	-304.88	11.60 <sup>†</sup>
Boston	759.08	752.33	-6.75	0.32	812.53	755.23	-57.30	0.99
Chicago	936.15	941.91	5.76	0.23	1053.27	1032.39	-20.88	0.51
Cincinnati	676.35	789.55	113.20	2.59 <sup>†</sup>	756.01	738.36	-17.65	0.48
NASDAQ	1358.10	1257.45	-100.65	2.19*	1432.86	1459.20	26.34	0.44
Pacific	608.82	599.59	-9.23	0.69	718.57	663.97	-54.60	2.21*
Philadelphia	770.16	731.20	-38.96	1.17	1022.52	1022.77	0.25	0.00

\* Statistically significant at the 5% level.

† Statistically significant at the 1% level

**Note:** The minimum tick size was reduced to \$1/16 in 1997 and to 1¢ in early 2001. Each panel reports the means, differences and test statistics for changes from 8ths to 16ths and 16ths to decimals. Means are computed 30 days before and 30 days after each change.

## CONCLUSIONS

We provide a comparison of NYSE and regional trading activity for NYSE-listed stocks over a ten year time period (1993-2002). We find that NYSE's percentage of volume is reasonably constant over the ten-year time period, but the percentage of trades executed on the NYSE is increasing. We find that three of the regional exchanges (the Cincinnati, Pacific and Philadelphia Stock Exchange) show declines in the percentage of volume of the NYSE-listed stocks over the ten-year time period, while NASDAQ registers an increase in its percentage of volume.

Up and down markets play an important role in determining the proportion of trades and volume that is executed on the NYSE relative to the other exchanges. In particular, we find that trades move to the NYSE in down markets. Mondays are characterized by a movement in

trading activity away from the NYSE. We hypothesize that this is related to increased regional-based retail order flow that follows the weekend.

We find that the NYSE increases its percentage of trades and volume from 30 days before to 30 days following the change in minimum tick size to decimals. Most of the regional stock exchanges show declines in percentage of trades and volume following the change in minimum tick size to  $\$1/16$  and to decimals. Overall, the NYSE appears to benefit at the expense of the regionals following tick size reductions.

## APPENDIX 1: SUMMARY STATISTICS OF ABSOLUTE VALUES

Exchange	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
<b>Panel A: Number of Trades</b>										
NYSE	25,671,426	27,109,407	30,731,430	37,964,090	54,056,917	71,815,422	86,906,114	107,655,315	154,869,853	224,797,532
Boston	1,545,440	1,490,218	1,936,588	1,684,710	2,654,842	4,735,763	7,078,281	8,813,942	9,036,901	13,257,077
Chicago	3,810,972	3,636,224	3,960,037	4,045,029	5,832,094	9,216,976	12,855,468	15,839,010	13,526,923	14,177,339
Cincinnati	1,678,539	2,136,070	3,201,313	3,276,805	3,194,216	2,905,900	3,822,609	6,142,765	4,145,726	2,251,936
NASDAQ	5,805,004	5,851,226	8,362,913	10,326,737	13,652,929	18,270,315	25,649,967	29,796,035	27,020,174	37,099,817
Pacific	3,373,555	3,155,236	3,842,674	4,193,766	4,957,632	5,761,908	7,386,642	6,224,207	1,600,167	1,297,030
Philadelphia	1,687,393	1,526,661	1,593,563	1,812,797	2,115,507	2,126,311	2,384,686	2,922,683	2,209,682	1,857,263
<b>Panel B: Volume (divided by 1,000,000)</b>										
NYSE	60,846.11	67,480.70	79,756.84	95,396.54	123,137.79	156,053.83	186,688.13	240,971.57	274,975.59	316,147.04
Boston	932.10	945.54	1,203.47	1,232.42	1,525.99	2,619.91	3,737.54	4,529.27	5,321.26	9,081.49
Chicago	2,715.00	2,697.47	3,073.56	3,236.50	4,412.09	6,724.78	8,765.07	11,515.02	12,389.43	14,162.76
Cincinnati	945.42	1,268.44	1,723.24	1,690.14	1,691.48	1,561.45	1,984.26	3,370.87	2,608.43	1,851.08
NASDAQ	4,651.78	5,284.17	7,161.01	8,734.96	10,477.62	14,042.47	18,671.90	22,629.60	25,784.45	35,944.83
Pacific	1,762.21	1,630.76	1,935.41	2,226.99	2,630.07	3,065.36	3,829.52	3,195.31	928.55	773.87
Philadelphia	884.41	896.43	995.31	1,102.74	1,242.84	1,194.43	1,294.37	1,677.70	1,513.83	1,539.19
<b>Panel C: Number of Firms Trading on Each Exchange</b>										
1 Exchange	20	6	5	3	6	3	6	1	2	20
2 Exchanges	103	92	74	81	70	77	91	99	143	169
3 Exchanges	221	227	227	229	272	301	369	384	458	396
4 Exchanges	354	414	408	370	422	461	456	446	438	553
5 Exchanges	404	485	511	427	503	612	611	551	464	499
6 Exchanges	629	725	815	1130	1117	1068	794	624	557	502
All 7 Exchanges	632	614	646	602	645	570	719	826	693	606
Total # of Firms	2363	2563	2686	2842	3035	3092	3046	2931	2755	2745

**Note:** This table shows the number of firms and average price for each year (1993 through 2001) for the sample of NYSE listed stocks (panel A). Panel B the percentage of the number of trades that occurs on each of the exchanges that trade NYSE listed stocks (NYSE, Boston, Chicago, Cincinnati, NASDAQ, Pacific, and the Philadelphia Stock Exchanges). Panel C shows the percentage of volume that each exchange receives for each of the nine years in the sample. Panel D shows the average size of a trade that occurs on each of the exchanges that trade NYSE listed stocks from 1993 through 2001.

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