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December 8, 2004

U.S. Securities and Exchange Commission
450 5th Street, N.W.
Washington, DC 20549-0609

Attention: Mr. Jonathan G. Katz, Secretary

***Re: File No. S7-10-04, Regulation NMS, Release No. 34-49325
(February 26, 2004) (the "NMS Release") and File No. SR-NYSE-
2004-5, Release No. 34-50173 (August 10, 2004)***

Ladies and Gentlemen:

I am writing on behalf of Fidelity Investments to present a preliminary study our market structure and economics research team has done to compare the implicit costs of trading NYSE-listed stocks on the New York Stock Exchange to the implicit costs of trading those same securities in other, voluntarily linked market centers: NASDAQ, ECNs and the Archipelago exchange. The study refers to these other market centers as "the Electronic Market." The data used for the study are the "dash-5" data filed with the Commission pursuant to Rule 11Ac1-5 under the Securities Exchange Act of 1934 for the NYSE and each of the market centers in the Electronic Market.

The study indicates that the "hybrid" market on the NYSE is a substantially more costly trading environment than that of the fully automatic trading environment of the Electronic Market. That differential is important to all investors — both individual and institutional.

The NYSE has suggested that its proposed hybrid market combines the best elements of a floor-based trading venue and electronic trading facilities. Our study indicates, however, that a hybrid market which preserves the ability of floor members to intervene in or slow the process of interaction between automated orders to buy and sell

stocks may detract from the quality of executions received by investors. We urge the Commission to take our study into account in making its decisions on Regulation NMS and the NYSE's Direct+ proposal.

The enclosed study does not take into account non-public information in the possession of the NYSE and NASD concerning executions in those markets. Although such data may shed additional light on these issues, it seems to us unlikely that such data would lead to any different conclusions regarding the superior executions provided by the fully automated Electronic Market.

* * *

We appreciate the opportunity to raise these questions with the Commission. If members of the Commission or the staff wish to discuss these matters, please call either me (617-563-7000) or our counsel, Roger D. Blanc (212-728-8206).

Respectfully submitted,



Attachment

cc (w/att.): The Hon. William H. Donaldson, Chairman
The Hon. Paul S. Atkins, Commissioner
The Hon. Cynthia A. Glassman, Commissioner
The Hon. Harvey J. Goldschmid, Commissioner
The Hon. Roel C. Campos, Commissioner
Annette L. Nazareth, Esq., Director,
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**Comparison of effective spreads for the NYSE trades
versus Electronic Market trades in the NYSE listed stocks, as published in
reports filed pursuant to Exchange Act Rule 11Ac1-5**

By: Ginger Meng* and Ani Chitaley**

Version 1.1 — November 7, 2004

Abstract:

Several prior studies comparing implicit execution costs on the NYSE and on Electronic Markets,¹ for individual investors' orders and small institutional orders have used reports filed pursuant to Rule 11Ac1-5 under the Securities Exchange Act of 1934 (dash-5 reports).² Some studies have paired NYSE and NASD stocks. The pairing methods attempt to answer the following question: When an individual investor trades NYSE and NASD stocks in their respective markets, which market gives lower implicit costs to the investor? Other prior studies have attempted to answer a different question: When an individual investor trades NYSE stocks, does the NYSE's existing hybrid system offer lower or higher implicit costs than the Electronic Market? We have also attempted to answer this second question, using more recent (2003) dash-5 data for a wider sample of 1,138 NYSE symbols. We find that, in the case of individual investors' market orders and small institutional market orders in NYSE stocks, implicit trading costs³ are lower on the Electronic Market than on the NYSE's existing hybrid system. The typical explanation proposed by prior research for the NYSE's observed inferior performance is

¹ We use the term "Electronic Market or Electronic Market Center" to refer to the combination of NASDAQ book available to brokers and market makers who are members of NASD, the ECN books available to all brokers, market makers and investors sponsored by brokers, and Archipelago. All these electronic markets are voluntarily inter-connected.

² Adoption of Rule 11Ac1-5 was announced in Securities Exchange Act Release No. 43590 (November 17, 2000).

³ Investors face additional explicit commissions charged by brokers. Brokers charge commission rates of cents per share or dollars per order, independent of whether the stocks are NYSE or NASD stocks. The commissions are independent of the market in which the customer order is actually traded. Hence the explicit costs of commissions do not affect our cost comparisons across markets. Also, the dash-5 data do not include information on commissions or fees, and, as a result, the reported effective spreads provide means of comparing only implicit trading costs.

selectivity bias, such that the NYSE might be receiving a larger proportion of “difficult” market orders. Difficult market orders are generally assumed to be placed in difficult market conditions. For any given stock, order difficulty is assumed to increase with quoted spread, price momentum in the direction of the order (also called information content) and order size. Our analysis suggests that implicit trading costs on the NYSE’s existing hybrid system are inferior to those on the Electronic Market, even with similar ranges of quoted spreads and order sizes. More accurate comparisons, however, between the intrinsic capabilities of the NYSE’s hybrid system and of the Electronic Markets for providing lower costs to investors would require further research based on detailed trade-and-order data maintained by the respective markets. We suggest that a full understanding of intrinsic capabilities would be desirable for policy makers who are contemplating major changes in the current U.S. equity market structure.

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Approach:

We used market order and related execution-quality data from the 2003 dash-5 reports for 1,138 NYSE symbols in comparing the implicit execution costs for individual investors and small orders (less than 10,000 shares) that were electronically received and executed through the NYSE's hybrid system versus the Electronic Market. We describe below our approach to collecting and filtering the required data.

1. The NYSE's SuperDOT⁴ order flow is most relevant for individual investor orders and small orders received from institutions by the NYSE:

The objective of our analysis is to compare trades executed for NYSE stocks on the NYSE versus Electronic Markets, on behalf of individual investors and institutions with small (less than 10,000 shares) orders. Hence it is important to understand how such orders are received and treated by the NYSE, and to locate appropriate databases required for analysis.

Anecdotal evidence and interviews with brokers suggest that such orders are most typically sent to the NYSE through SuperDOT. While accurate data is not publicly available, for the purpose of the current analysis, it would be reasonable to assume that orders sent to the NYSE via SuperDOT (accounting for about 90% of orders received by the NYSE and about 60% of shares executed in the NYSE) contain almost all orders from individual investors and also contain small orders from institutions.

⁴ The NYSE's Super Designated Order Turnaround System (SuperDot)[®] is its primary order processing system that supports equity trading on the trading floor and provides the NYSE with the current status of any equity order. NYSE member firms transmit market and limit orders directly to the trading post where the security is traded. After the order has been completed, an execution report is returned directly to the member firm over the same electronic circuit that brought the order to the NYSE trading floor. SuperDot can currently process about seven billion shares per day.

Orders sent to the NYSE through SuperDOT receive the same order-handling treatment, irrespective of whether they are from institutions or from individual investors. If the order size is up to 1,099 shares, the orders are generally handled subject to the auto-execution rules of the NYSE's Direct+ system. If the orders are for more than 1,099 shares, they are subject to and are available for specialist and floor trader participation. Hence it is reasonable to assume that SuperDOT orders received by the NYSE are executed in accordance with the NYSE's current hybrid system of auto execution, integrated with specialist-facilitated floor auctions. When the specialist uses his/her capital to trade against a SuperDOT order, the specialist acts like an NASD market maker (also referred to as the "third market market-maker"), except that the specialist holds a monopoly on the transactions. In the case of NASD, multiple market makers compete with each other in the use of capital.

On the basis of further anecdotal evidence and broker interviews, we understand that small orders of less than 10,000 shares, if from institutions, do sometimes go directly to the floor brokers, but such orders account for no more than 10% of total shares traded on the NYSE. The bulk of institutional orders received directly by the floor brokers are for blocks (greater than 10,000 shares), and are treated as "market not held" orders. Such orders account for approximately 30% of the shares executed on the NYSE.

2. Dash-5 reports provide the most relevant publicly available data for individual investor orders and small orders from institutions:

Exchange Act Rule 11Ac1-5 mandates that all markets in the United States report order data and regular-way execution data received for all stock orders of less than 10,000 shares. For the initial period, and as of this date, the SEC has exempted non-electronically received orders from such reports. These reports include data only on orders received electronically. They include all orders for less than 10,000 shares received from individual investors and institutions, through the NYSE's SuperDOT and in all other Electronic Markets. Dash-5 reports include market orders and limit orders (including immediate-or-cancel orders) received by a market center during regular trading hours at a time when a consolidated best bid and offer is being disseminated, and,

if executed, are executed during regular trading hours. They do not include any order for which the customer requests special handling, such as orders to be executed at the market opening price or closing price, orders submitted with stop prices, orders to be executed only at their full size, orders to be executed on a particular type of tick or bid, orders submitted on a “not held” basis, orders for other than regular settlement, and orders to be executed at prices unrelated to the market price of the security at the time of execution. The dash-5 reports provide us with the most relevant publicly available data for our analysis of individual investor orders and small orders from institutions.

3. Description of data:

We analyzed effective spread data available in the dash-5 reports for the twelve months of 2003, as published by Transaction Auditing Group, Inc. (“TAG”) on its website. The definitions of effective spread and different types of orders are given in Appendix I. Types of orders included or excluded in the dash-5 reports are given in Appendix II.

We started with all of the 2,557 NYSE securities existing as of December 31, 2002. From this list, as shown in Appendix III, we eliminated foreign-incorporated securities, ADRs, REITS, certificates, SBIs, units, closed-end funds etc., leaving us with the 1,329 NYSE common stocks. This list was further reduced to the 1,138 NYSE securities after removing securities whose daily trading volume was less than \$20,000, whose average closing price was less than \$3 (with some exceptions), as well as securities which changed listing between NASD and the NYSE, or which had missing data, or for which data was not available in dash-5 reports, as shown in Appendix III. The final list of 1,138 symbols selected for analysis is given in Appendix IV.

The total market trading volume for these 1,138 symbols was 318 billion in 2003. Trading volume included in the dash-5 reports was 124 billion shares (39% of total market volume), representing trades for all orders less than 10,000 shares, received electronically by the market centers. The NYSE accounted for 108 billion shares, and the Electronic Market accounted for 9 billion shares (87% and 7% of dash-5 trading volume, respectively). On the NYSE, market orders accounted for 33 billion shares, and marketable limit orders accounted for 40 billion shares (31% and 37% of the NYSE’s

dash-5 volume, respectively). On the Electronic Market, market orders accounted for 4 billion shares, and marketable limit orders accounted for 2.5 billion shares (44% and 28% of the Electronic Market's dash-5 volume, respectively). Figure 1 shows further details of trading volumes and proportions for different types of orders.

In the 2003 dash-5 reports, we noticed that seven NYSE specialists and 32 NASD market centers including ECNs and the Archipelago Exchange, received and executed orders for the 1,138 symbols. We compared effective spreads for the NYSE and NASD market centers for these symbols. The NYSE specialist executions represent trades done through the NYSE's current hybrid system (electronic and specialist-facilitated floor auctions), where the specialist is held responsible for the execution quality and disposition of electronically received (SuperDOT) orders. The NASD market center executions represent electronic executions of the NYSE symbols, for orders received through NASDAQ, ECNs and Archipelago, where these market centers are responsible for the execution quality and disposition of received orders. The names of the seven NYSE specialists and 32 NASD market centers reporting the executions are listed in Appendix V.

4. Data for market orders for NYSE stocks, received electronically through SuperDOT and through other Electronic Markets:

Individual investors are more likely to place market orders than other types of orders. Chakravarty (2001) analyzed the NYSE's TORQ data for orders between 500 through 9,999 shares, for two months from November 1990 through January 1991. This study suggested that individual investors were less informed traders than institutions. When traders have more information, they are more likely to place limit orders, and not market orders. Bae et al. (2003) found that traders place more limit orders than market orders when the order size is large, when the spread is large, and when they expect high volatility.

The expectation of any investor who places a market order is to get a price at or within the National Best Bid and Offer that existed at the time of order submission to the broker

or directly into a computer screen provided by a broker, and to get the order filled immediately or with only minimal delay.

Hence we analyzed only market order data from the dash-5 reports. The TAG data for 2003 shows that market orders for the 1,138 symbols represented 33% of total dash-5 reported trading volume.

Similar ratios are observed for retail SuperDOT order data that is also available in the TAG dash-5 data. Although Exchange Act Rule 11Ac1-5 does not mandate separate reporting of retail (individual investor) orders and executions, the NYSE voluntarily publishes such data. Retail orders, however, are not always accurately identified. Interviews with a mid-size brokerage indicated that they do not tag their orders going to SuperDOT as retail or otherwise. Some brokers believe the NYSE treats as retail orders SuperDOT orders up to 1,099 shares and all other orders specifically tagged as “retail”.

5. Other types of orders that we excluded from analysis of dash-5 data:

a. Marketable limit orders:

It is commonly believed in the securities industry that most individual investors do not intentionally give marketable limit orders to their brokers. As seen from Appendix I, a marketable limit order to buy would have a price higher than the lowest national offer price. Such an aggressive buy order would generally be given by an institutional investor or professional trader acting on information. Because of the time delay between order entry by a customer and actual order receipt by a market center, sometimes a limit order at or within the NBBO at time of placement might be recorded as a marketable or non-marketable limit order since the NBBO at the time of order arrival at the market center might have changed. The treatment of marketable limit orders is significantly different between the NYSE and other electronic market centers. Marketable limit orders sent to Electronic Markets have a disadvantage over similar orders sent to the NYSE through

SuperDOT, in view of the provisions in the ITS rule⁵. The rule requires that an incoming ITS order cannot be cancelled for at least 30 seconds from the time of order entry. This effectively gives the NYSE specialist 30 seconds to respond to the incoming ITS order. The order is not guaranteed an execution, and the NYSE quote is not necessarily firm for the order.

On the NYSE, full execution of a marketable limit order can depend on specialist's or floor broker's participation and the execution can take longer than an auto execution in an electronic book. In an NASD market center, the entire order can be filled by auto execution through the publicly available depth of electronic books, and the aggregate execution may also include the volume shown in the NYSE ITS quote published in the consolidated quotation system.

Assume a scenario in which a limit order to buy 1,000 shares at \$20.13 is entered while the NBBO is a bid for 500 shares @ \$20.05 and an offer of 200 shares @ \$20.10. The NBBO mid point in such a case would be \$20.075 $\{= (20.05 + 20.10)/2\}$:

- If executed on the NYSE, the order could be filled for 200 shares @ \$20.10, plus 800 shares from the specialist or crowd at a price of their choice, say, \$20.12. This would give an overall volume-weighted average price of \$20.116 for the buy order of 1,000 shares, and the corresponding effective spread is 8.2 cents $\{= 2 \times (20.116 - 20.075)\}$.
- For the same quotes on an NASD market center, auto execution of the 1,000 shares could happen by lifting the offer of 200 shares @ \$20.10, and then sweeping the higher-priced offers to buy the remaining 800 shares. The overall volume-weighted average price for the 1,000-share execution, and the corresponding effective spread would depend on the depth of the published electronic books of NASD market centers. Note that the overall price is dependent on the existing, published quotes, and/or the interjection of the receiving market maker.

b. At-the-quote, inside-the-quote and near-the-quote orders:

⁵ See, e.g., NYSE Rule 15A.

This data has time-stamping uncertainty, similar to that of marketable limit orders. Dash-5 data for NYSE executions shows such orders represent 33% of shares executed for the 1,138 NYSE symbols. Electronic markets show negligible percentages for these three order types in these NYSE stocks, with numerous “null” records for effective spreads. Exchange Act Rule 11Ac1-5 does not require market centers to report on the execution quality (effective spreads etc.) for these three types of orders.

Analysis:

1. Limitations of dash-5 data used for our analysis:

Market centers, including the NYSE, have pointed out limitations of dash-5 data when used to infer execution quality of market centers: (1) Dash-5 reports cover only a limited portion of the NYSE volume, since they exclude orders sent to the floor, short sales, etc.; (2) The measure of effective spread as defined by Exchange Act Rule 11Ac1-5 fails to distinguish trades greater than the quoted depth from trades less than the quoted depth.⁶ (3) Transaction-level results are not available since only monthly aggregations are reported, and matched pairs of best quotes at the receiving market center and the corresponding NBBO are also not available. In summary, dash-5 data could be useful only for overall performance comparisons across market centers, for order flows as received by the market centers.

Despite these limitations, we found dash-5 reports to be relevant for the purpose of our analysis:

- From the perspective of an investor, comparison with the mid-point of the quote at the time of order entry could be viewed as one of the relevant measures of execution performance, irrespective of order size. The mid-point at time of order entry represents a “fair-value” of the stock, to an investor who wishes to enter his/her order

⁶ Paul B. Bennett’s presentation at “Innovation in Finance,” The 15th Annual Conference of the Financial Markets Research Center, supported by a special grant from the NYSE, held on April 11-12, 2002, Vanderbilt University.

in the market at that time. If a market has insufficient depth, and an investor's buy order is filled through several sequential executions, the investor would wish to know the overall purchase price, calculated as the volume-weighted execution price for the total fill. The investor would also wish to know the amount by which the purchase price was more or less than the "fair value" (that was expected for the purchase). Effective spread is defined as twice this difference amount, and dash-5 reports include monthly share-weighted averages of effective spreads for different securities, market centers and size categories.

- Dash-5 data is the only publicly available source of execution quality measures across different markets where all are using the same standardized definitions of execution quality. The quality of dash-5 data has been improving since 2001.
- Dash-5 reports contain almost all of the required execution quality data since most retail and institutional orders, less than 10,000 shares, are now being submitted electronically to the NYSE through SuperDOT.

2. Effective spread comparisons between the NYSE and Electronic Markets:

As stated above in Approach, subsection 4, our analysis focused only on market orders because individual investors are more likely to place market orders. Market orders in an auto-execution order-handling process that features price-time-priority should be expected to get the quoted offer price for a buy order or a quoted bid price for a sell order if the order size is not greater than the quoted sizes in the offer or bid. In this case, the effective spread would be equal to the quoted spread. However, if the NYSE specialist or floor broker, or an NASD market maker, interjects to provide a better price to the incoming order, then the resulting execution would give an effective spread for the executed quantity narrower than the quoted spread. The expectation of an investor placing a market order is very simple: "At this instant I see an NBBO and I calculate the mid point as a "fair" price to expect. So, execute my buy order as fast as possible, as close to the mid point as possible, yet not above the best offer." After the market order is executed, the effective spread can be calculated to measure the degree to which the investor's "fair" price expectation was met.

Referring to Figures II through V, we observe that:

- a. The overall effective spread reported by Electronic Market Centers has a share-weighted mean of 2.17 cents, versus a wider spread of 3.06 cents for the NYSE, the difference being statistically significant (Figure II).
- b. 24 out of the total of 32 Electronic Market Centers reported narrower effective spreads than the 3.06 cents reported by the NYSE. Knight Capital Markets, Bernard L. Madoff and Schwab Capital Markets accounted for 82% of the total shares executed for orders received by Electronic Market Centers. These three market centers reported an effective spread of 2.09 cents, versus the NYSE effective spread of 3.06 cents (Figure III).
- c. Electronic Market superiority of reported effective spreads (versus the NYSE) is even greater for small orders (less than 500, and between 500 to 2,000 shares), which would be more representative of executions done for individual investors (Figure IV).
- d. For the market as a whole, including the NYSE, and the Electronic Market, the overall share-weighted effective spread for market orders diminished over the 12 months of 2003 (Figure V). This suggests that competition for and selectivity of order flow between the Electronic Market Centers and the NYSE has been beneficial to investors.

3. Comparison of intrinsic capabilities of the NYSE's existing hybrid system and Electronic Markets:

To compare accurately the intrinsic capabilities of the NYSE and Electronic Markets, it would be useful to identify the sensitivity of their effective spreads to changes in market conditions, causing changes in order "difficulty." Recent work by Lehn et al. (2004) appears to indicate that the NYSE's hybrid system is less effective than some Electronic Market centers, in dealing with news- or event-driven market swings.

It would be preferable if future research were to use order and transaction-level data and focus on market orders across all market conditions and all Electronic Markets. Such data, which is available only within each market center, would more accurately answer the following questions:

- What are the actual market factors that define the “difficulty” for executing market orders for a given NYSE stock?
- What are the effective spreads for orders of similar “difficulty,” in the NYSE’s hybrid system, and separately in the Electronic Market?

3a. Intrinsic capabilities of Electronic Market Centers:

The share-weighted average effective spread of two Electronic Market centers, namely Archipelago and Instinet, is 2.75 cents compared to the NYSE’s effective spread of 3.06 cents. ECNs have no explicit “market maker” or “specialist” intervention. Smart routers which can route orders to ECNs effectively allow incoming market buy or sell orders to trade at the best displayed offer or bid that is available in the Electronic Market. If the NYSE or the NASDAQ book or another ECN has a better quote, then the market order is sent through SuperDOT or ITS to the NYSE, or through private networks to another ECN or NASDAQ. Hence effective spreads in Electronic Markets such as ECNs depend highly on the depth of quotes or liquidity available from other investors and market makers.

It would be reasonable to assume that order flow to ECNs is a typical mix of “easy” and “difficult” orders. ECNs, by design, cannot be selective about the orders they receive or execute, and thus cannot elect to receive or execute only “easy” orders. The lower execution cost for orders received by ECNs might be indicative of the superior intrinsic order-handling performance by Electronic Markets which have order-driven auto-execution. While it is possible that order-entry firms perform a selection function to prefer one market over others for “difficult” orders, there is no data that we are aware of,

to show that order-entry firms routinely select the NYSE over other markets for such orders.⁷

In a hybrid market such as the NYSE, the effective spread provided to an investor order depends on the specialist's participation. Bondarenko et al. (2003) suggest that a specialist's participation might depend on the depth of the limit order book and its uncertainty. Seppi (1997) suggests that, in a hybrid system like the NYSE, a specialist would trade to maximize his /her profits by executing arriving market orders in the face of competition from limit orders. This would mean that price improvement for market orders is contrary to specialist's profits. Panayides et al. (2004) analyzed the NYSE's TORQ data from November 1, 1990 through January 31, 1991, for 144 NYSE stocks (before decimalization). They proposed a specialist's inventory-balancing model and suggested that the specialist might self-subsidize his/ her costs when the constraints of the NYSE's price continuity rule are not binding. The authors showed that the specialist loses money when he/ she is passive (participation when price continuity rule is binding), but makes money when he/ she is active (participation when price continuity rule is not binding). One implication of this finding is that the self-interests of the specialists might be contrary to better execution prices for investors since the specialists are in business to make profits (within the constraints of the NYSE regulations).

3b. Effect of order "difficulty" on execution costs (effective spread):

Since various inter-connected cost factors are used to evaluate execution performance and order "difficulty," some definitions might be useful to keep in mind:

Execution cost factors for a given number of shares bought with a purchase order:

$$\text{Effective Spread} = 2 \times (\text{Purchase Price less } [\text{Mid Point}]) \quad (1)$$

$$\text{Effective Spread} = [\text{Quoted Spread}] \text{ less } 2 \times \text{Price Improvement} \quad (2)$$

⁷ See Figure VI, which casts doubt on the arguments that the NYSE's performance was adversely affected by selectivity bias so that it received a disproportionate share of "difficult" orders.

$$\text{Realized Spread} = \text{Effective Spread less } 2 \times [\text{Mid}_5 - \text{Mid Point}] \quad (3)$$

$$\text{Price Impact} = 2 \times [\text{Mid}_5 \text{ less Mid Point}] \quad (4)$$

In the above equations, Price Improvement, Price Impact and Mid₅ are calculated as: Price Improvement = Ask less Purchase Price; Price Impact = Effective Spread less Realized Spread; Mid₅ = Mid Point of the NBBO, five minutes after completion of order.

From equations (1) through (4), note that [Mid Point], [Quoted Spread] and [Mid₅] are three variables that describe market conditions for the purchase order. All other factors such as Effective Spread, Price Improvement, Price Impact and Realized Spread are calculations representing the characteristics of execution costs. Note also that for given market conditions, Price Improvement, Price Impact and Realized Spread are directly related to Effective Spread. In other words, if we know Effective Spread and two factors of market conditions surrounding the order (example: Quoted Spread and [Mid₅ less Mid Point]), then we have the full picture of cost relative to market conditions. The variable [Mid₅ less Mid Point] is an approximation representing the movement of the stock price after the execution. When aggregated over several executions, it could be interpreted as a measure of difficulty for liquidity providers, including market makers and specialists.

Quoted Spread is a factor that measures order “difficulty.” Our analysis shows that for similar share-weighted average quoted spread-ranges, Electronic Market provides lower effective spreads than does the NYSE (Figure VI). For this analysis, we segmented all monthly symbol records from our dash-5 data set into eight ranges of Quoted Spreads, from four cents or less through 16 cents or more. Then we calculated the share-weighted effective spreads for all the NYSE records in each of the eight Quoted Spread segments. We repeated the calculation for all records in the Electronic Market. The results suggest that the Electronic Market might be more effective than the NYSE hybrid system in providing lower effective spreads for market orders, for small as well as large Quoted Spreads.

Order size is another factor that indicates “difficulty.” Executions for large orders are generally expected to have higher effective spreads than those for small orders. Even for

this “difficulty” factor, our analysis indicates that Electronic Markets provide lower effective spreads than does the NYSE (Figure IV).

A particular limitation of dash-5 reports must also be kept in mind while interpreting the effects of order flow selectivity. Effective spreads and other execution cost factors are reported by the receiving market center for all executions against all orders received by the market center, irrespective of whether the order was partially or fully executed inside the market center or was passed on to other market centers, and executed by them. This means that the effective spread reported against a market center includes the result of how effectively that market center traded orders and how effectively the other market centers which received remaining portions traded the remaining orders.

On the basis of the above clarification of dash-5 data, we observe that if the reported NYSE effective spread is higher than the Electronic Market effective spread, it could not simply be due to Electronic Markets passing on difficult orders to the NYSE because the inferior results for the corresponding NYSE executions would be included in the results reported by the market center. In fact, one of the intentions of Exchange Act Rule 11Ac1-5 was to hold the receiving market centers responsible for the total result of executions for the orders they receive, and not simply for their own executions. Individual investors generally do not care, nor do they always know, if their order was executed by the market center to which it was sent, or was executed by other market centers which were passed on the order. Investors care about the final results, and the receiving market centers compete with each other to provide the best results for the orders they receive.

4. Prior Research:

Bessembinder (2003), Lipson (2004), and Boehmer et al. (2003) have all used dash-5 data on order flow and execution quality for NYSE stocks reported by the NYSE and by selected non-NYSE market centers. Their studies also appear to suggest that the NYSE’s effective spread for its own stocks is not always the lowest, compared to executions in other electronic markets. Data used in our analysis covers more number of stocks over a more recent full-year period, compared to prior studies.

The above prior studies have also attempted to draw further conclusions from the dash-5 data. In particular, the studies have attempted to find the reasons behind the observed differences in execution costs (as measured by effective spreads) on the NYSE versus other market centers. The studies have indicated that one of the reasons for lower effective spreads reported by the non-NYSE market centers compared to the NYSE could be that the non-NYSE market centers received order flow under “easier” market conditions. In other words, the NYSE could have received a larger proportion of “difficult” orders than the proportion received by Electronic Markets. However, these studies have not explicitly reported the proportions of “easy” or “difficult” orders received by the market centers, nor have they demonstrated that other market centers are sending “difficult” orders to the NYSE. Our dash-5 data set for the 1,138 NYSE symbols shows that the Electronic Market centers and the regional exchanges could not have contributed more than 1% of the total market orders received by the NYSE through SuperDOT and ITS. It is also possible, however, that some non-NYSE market centers might not be correctly reporting their “in” and “away” execution volumes.

4a. Bessembinder (2003)

Bessembinder’s study used two months (July and August 2002) of dash-5 data for 500 NYSE stocks. The study found the simple mean effective spreads of Instinet, Madoff and Knight (between 1.95 cents to 4.89 cents) to be lower than the NYSE’s effective spread of 6.95 cents. Bessembinder then applied various explanatory factors in a regression equation, and also applied variables created from Probit estimation to control for selection biases. The purpose was to compare execution cost results across market centers, after adjusting for order “difficulty” and other variables. The complete list of explanatory variables and Probit controls is explained in Table 4 of Bessembinder’s paper.

Bessembinder found that Instinet and Madoff effective spreads were lower than those of the NYSE, even after adjusting for regression variables representing order difficulty and adjusting for selectivity bias. Even Knight’s effective spread was superior to the NYSE after adjusting for regression variables, but was inferior after adjusting for selectivity

bias. However, the p-value for a null hypothesis was high for this latter case, and this reduced its statistical significance.

Bessembinder's methodology could be extended in future work, to understand the reasons behind the lower effective spreads for Instinet and Madoff compared to the NYSE, even after adjusting for regression variables and selectivity bias. Are there some structural reasons (not accounted for in the study) that might suggest superior intrinsic performance of the ECN and the NASD market makers compared to the NYSE's hybrid system?

4b. Lipson (2004)

Lipson's work reports simple average effective spreads of 11.5 cents for market orders on the NYSE, versus 3.81 cents, 6.17 cents and 8.40 cents for Madoff, Archipelago ECN and Knight, respectively. These calculations were based on dash-5 data from July 2001 through June 2002, for a selection of 350 NYSE stocks. We tend to disregard the results for Archipelago because its execution volume was only 1% of the overall executions of the NYSE stocks, during the reporting period. Archipelago ECN had merged with RediBook ECN in March 2002, just before the study period, and investors had just begun directing orders in NYSE stocks to Archipelago.

Lipson goes beyond the comparison of execution quality for the NYSE stocks across market centers, and investigates potential reasons for the NYSE's inferior overall effective spreads versus those for the other market centers. Based on analysis of market conditions at time of order receipt, he suggests selective behavior by market makers and other non-NYSE market centers in directing investor orders to the NYSE, such that the NYSE receives a larger proportion of "difficult" orders than non-NYSE market centers. The latter tend to specialize in accepting orders with "easier" market conditions. Lipson defines the degree of difficulty through two primary factors: the Quoted Spread at time of order receipt, and the Realized Spread after the order execution. Lipson's regression analysis also suggests that Madoff's lower effective spread compared to the NYSE's could be explained at least partially by higher relative quoted spread, higher relative price

improvement, lower relative liquidity (turnover), smaller market capitalization (log of market value) and higher volatility for orders received by the NYSE versus Madoff.

Lipson concludes by stipulating that competition for NYSE stocks, amongst market centers, and the resulting fragmentation of order flow, might be contrary to a single, dominant, lowest cost architecture. While the study appears to explain the NYSE's higher effective spreads as due to more difficult orders, the analysis does not specifically support the argument that the NYSE's hybrid system could provide smaller effective spreads than those of competing market makers and ECNs, had the NYSE received "easier" orders. Hence Lipson's stipulation that competition appears to be contrary to a lowest cost market structure to investors remains unsupported by his analysis.

4c. Boehmer, Jennings and Wei (2003)

This study analyzed dash-5 data from June 2001 through February 2003 for 255 NYSE securities. The study period of 21 months is the longest amongst the three prior studies we discuss. The study found that routing decisions by broker-dealers and traders depend significantly on execution quality. Market centers reporting low execution costs and fast fills progressively received more order flow. The authors state that their results are "consistent with active competition for order flow that can be influenced by public disclosure in contrast to several allegations and admissions of non-competitive behavior in the recent past."

One of the goals for the dash-5 rule was to "empower market forces with the means to achieve a more competitive and efficient national market system for public investors."⁸ Boehmer's study suggests that competition was effective and that order flow was selectively moving to competing market centers. In future, similar studies could address the question of why the market share of a competing new exchange (Archipelago), which is electronic, has been steadily increasing.

⁸ SEC Release No. 34-43590 (November 17, 2000), last line under Introduction.

It might be realistic to assume that competition for order flow based on execution performance would facilitate continued improvement of execution performance across all markets and would thereby benefit all investors in the long run.

Conclusions:

Our current research shows that executions of market orders up to 10,000 shares for NYSE stocks have better (lower) effective spreads on Electronic Markets, than executions of market orders received by the NYSE specialists. The share-weighted effective spread is 2.17 cents for Electronic Market executions, versus 3.06 cents for the NYSE.

Effective spreads on Electronic Market Centers are even more advantageous than the NYSE effective spreads for small market orders. Small market orders are more representative of orders from individual investors than of institutional orders.

Our study also suggests that Electronic Markets provide lower effective spreads, for market orders in NYSE stocks, for all order sizes, and for large as well as small quoted spreads.

In its monthly “Market Quality” report,⁹ the NYSE claims that its execution quality as measured by effective spreads is superior to that of NASD, including market makers and ECNs. Our analysis raises doubts about the validity of these claims, in the context of individual investor orders and small institutional orders. In the same report, the NYSE also claims superiority over NASD by quoting results supplied by industry benchmarking firms that measure institutional trade execution quality. While this comparison of institutional trading capability is outside the scope of our current research, it is important to note that the benchmarking firms compare the “all-in” execution prices for daily or multi-day trades received by institutions from brokers, with “reference” prices that are

⁹ Published on nyse.com. See “New York Stock Exchange Market Quality,” in the “Disclosure of Order Execution” section, under the “Best Ex/11Ac1-5” tab. Refer to the August and September 2004 issues.

based on the benchmarking company's models. The execution price obtained by an institution is highly dependent on its trading strategy, trading skill and effectiveness of working with brokers. It is not the execution price for each small order or partial print executed in the market center on behalf of the institutional investor. As such, these benchmarking reports do not represent execution quality comparisons between markets.¹⁰

There are two key questions (amongst others) that could be helpful in making informed decisions about changing the NYSE's current hybrid system:

- Would competition between market centers, for attracting and trading order flow be hindered by the proposed changes to the NYSE hybrid system? Dash-5 data points to the benefits of competition in reducing trading costs to investors.
- Which market system is better, the NYSE's recently proposed expanded hybrid system, or the system of fully electronic, interconnected market centers with auto execution? Under similarly difficult market conditions, which system would provide lower execution costs to investors?

Further quantitative research is needed to respond to these questions accurately.

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¹⁰ The reference prices are calculated from market data for trades reported in the consolidated market. The execution price used by these firms is the "all-in" share-weighted average price for the total execution for the whole day or for multiple executions over multiple days. Some benchmarks also include commissions charged by brokers. Furthermore, the benchmarking comparisons are for institutional execution quality for NYSE stocks versus NASD stocks, and are not for NYSE stocks traded on the NYSE versus Electronic Market.

Cap Trading, LLC, and two other broker-dealers for their explanations of the order-handling process in the NYSE and NASD markets. The two broker-dealers wish to remain anonymous. Jamie was also gracious in verifying some of our observations and providing ideas for our analysis. Our special thanks also go to Erik Sirri, Professor of Finance, Babson College, Massachusetts, for his review and comments of our paper, and to Vinod Pujar, Manager of High Performance Computing with Fidelity's Global Equity Trading division, for his diligent and resourceful efforts in collecting and understanding the dash-5 reports. Without his help, this work would not have been possible. Our thanks also go to other members of Fidelity's Global Equity Trading, Trading Techniques and Measurement group. The analysis presented and opinions expressed here are those of the authors only. They do not necessarily represent the views, opinions or approval of Fidelity Investments. Contact the authors at 82 Devonshire Street, E30B, Boston, Massachusetts, or at mengj@bc.edu, or ani.chitaley@fmr.com.

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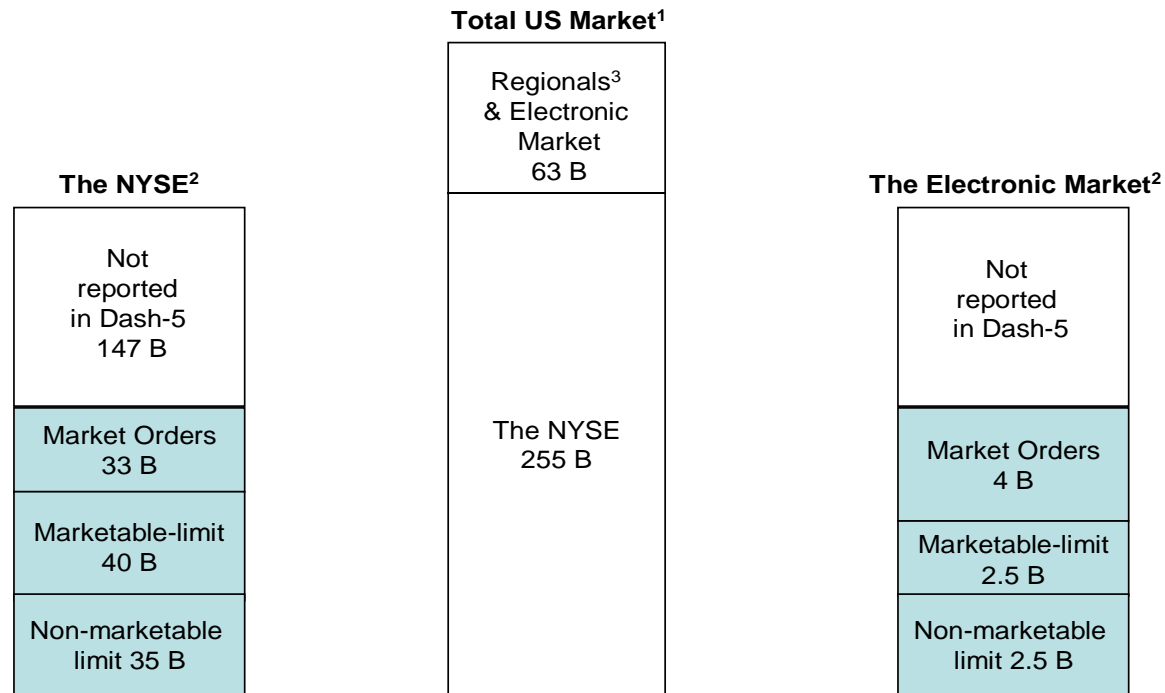
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**Figure I – Total Market Volume (Shares Traded) And
Dash-5 Reported Volume For 1,138 NYSE Symbols in 2003**



Bar heights are not proportional

1. Total market volume (based on market data from Bloomberg, B = billion shares): 318 B.
2. Due to potential double counting, dash-5 reported executed shares (shaded boxes) have been divided by 2 to represent trading volume. Total dash-5 trading volume: 124 B; Market orders: 41 B; Marketable limit: 44 B; Non-marketable: 39 B
3. Total dash-5 volume on Regionals (not shown): 7 B; Market orders: 4 B; Marketable limit: 1.5 B; Non-marketable: 1.5 B.

**Figure II - Overall Effective Spreads
Of Market Order Executions**

| | total # of shares executed for orders received by market center per month | total # of shares executed at the market center per month | median (cents) | share weighted mean (cents) | $H_0: \mu_{NYSE} = \mu_{Electronic}$ |
|--------------------------------|---|---|----------------|-----------------------------|---|
| Reported by NYSE Specialists | 5,447,491,775 | 5,438,927,034 | 4.32 | 3.06 (0.0288) | test statistic = 12.76 p-value = 0.0000% |
| Reported by Electronic Markets | 745,654,076 | 675,368,946 | 2.60 | 2.17 (0.0638) | |

Standard error is reported in () parenthesis.

**Figure III - Effective Spreads And Executions
By Different Electronic Market Centers**

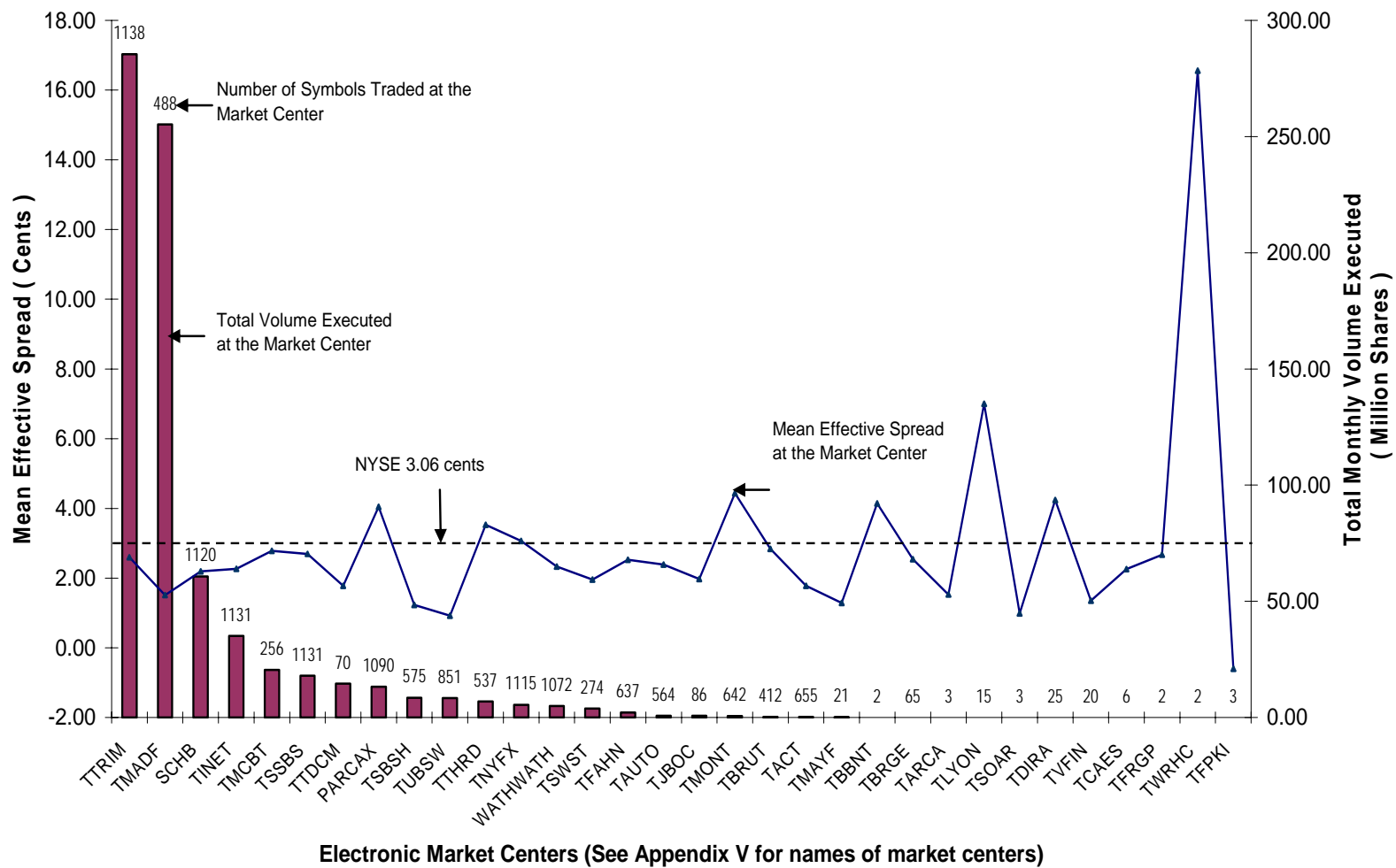
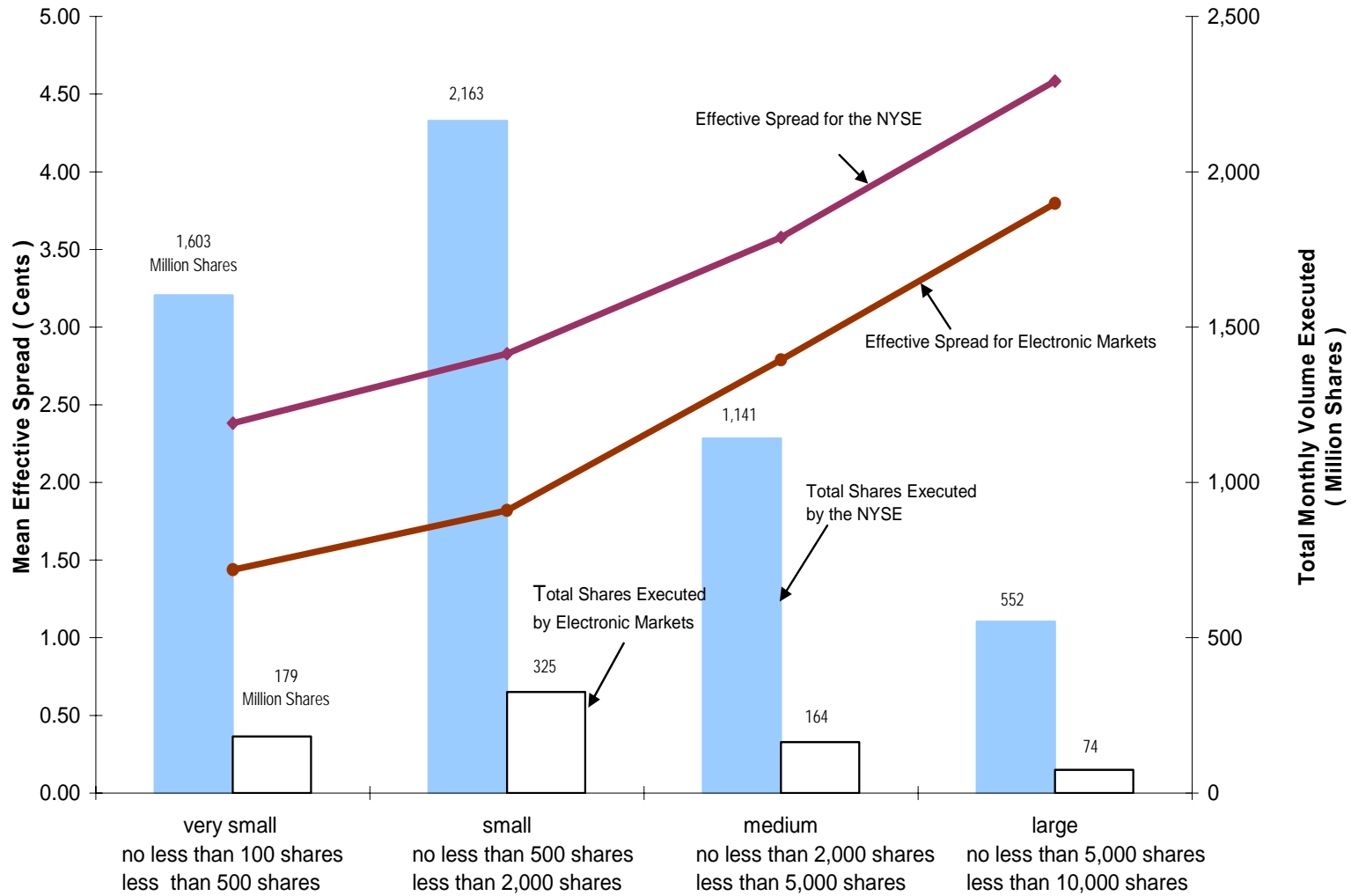
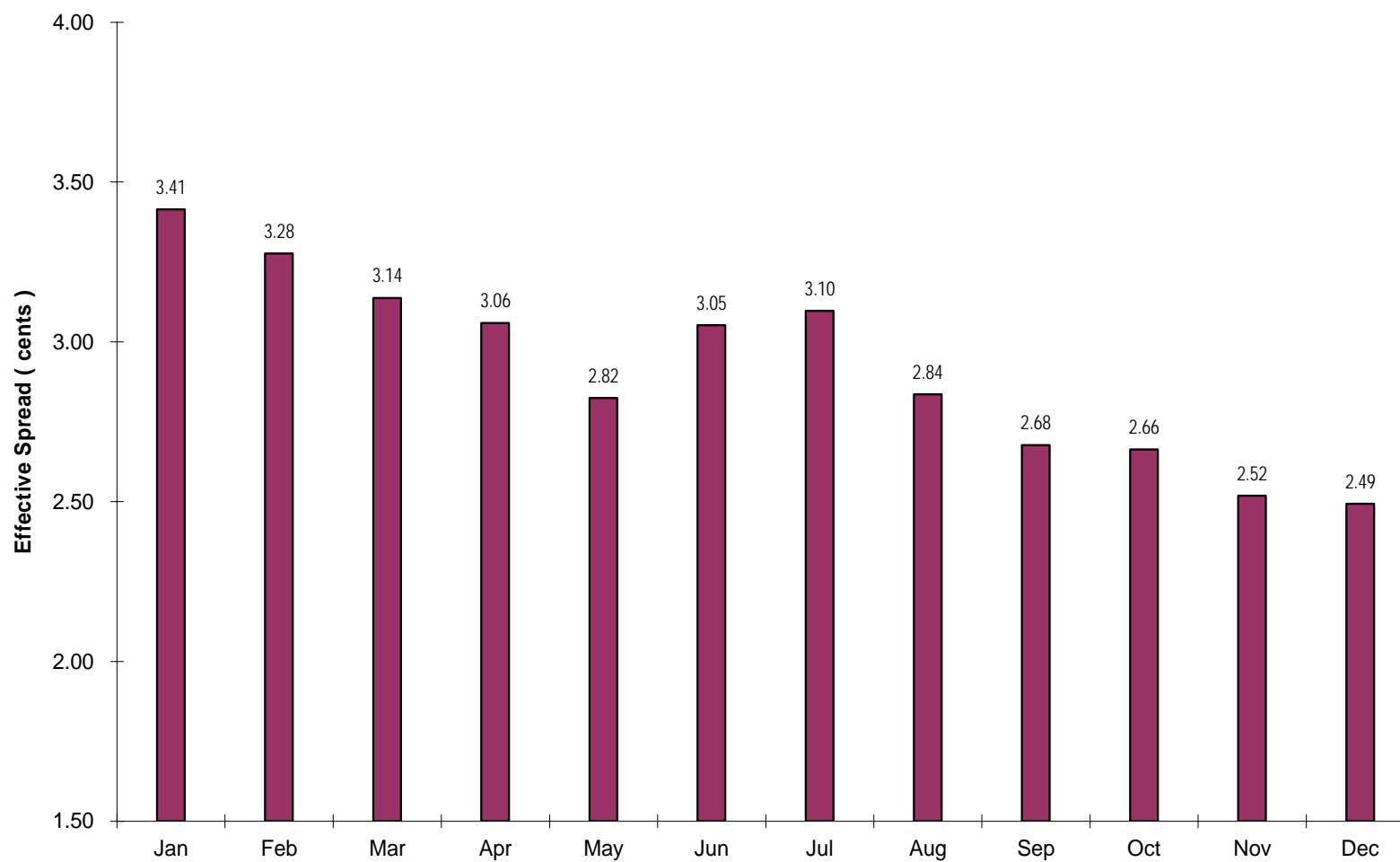


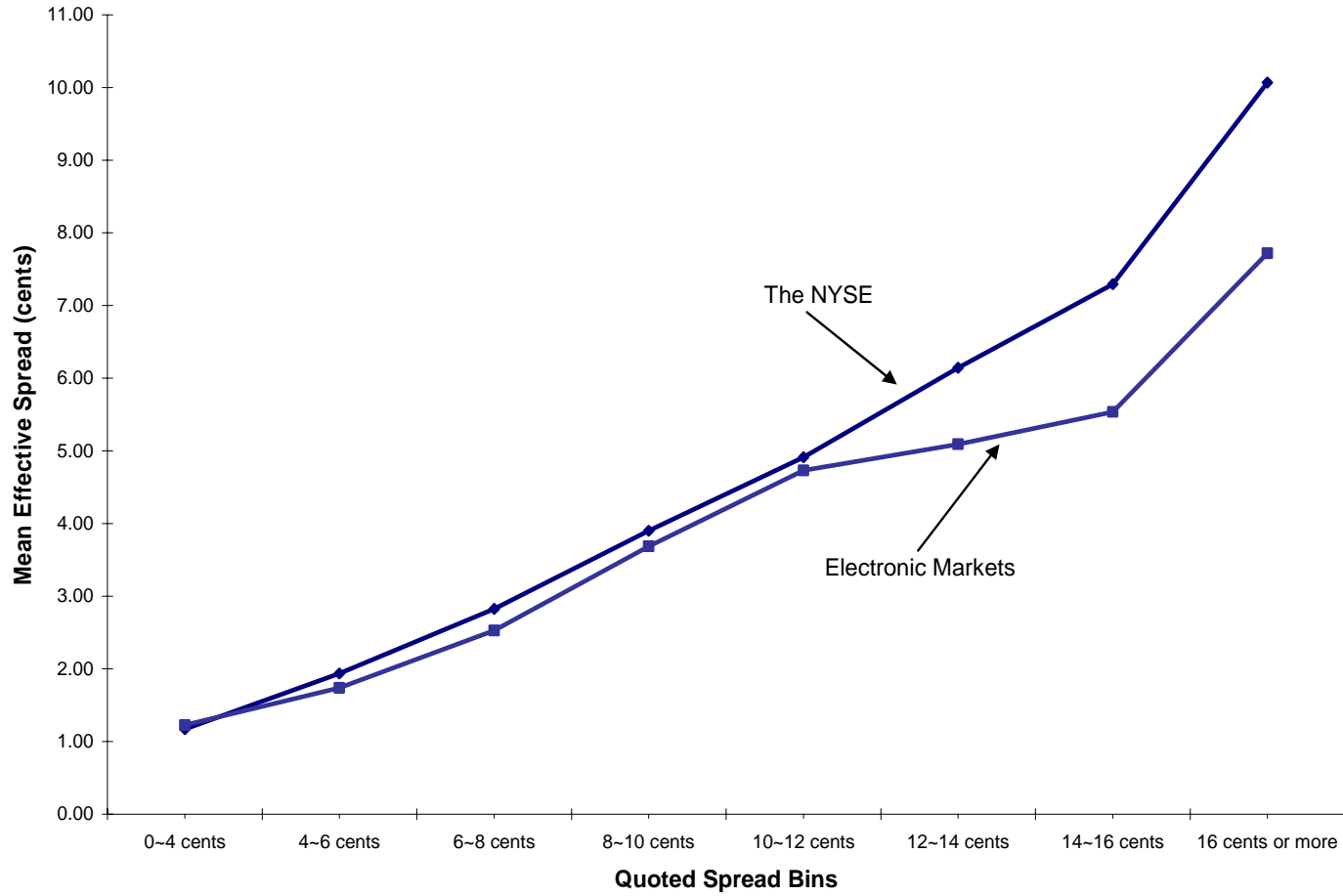
Figure IV - Effective Spread Versus Market Order Size



**Figure V -Effective Spreads Of 1,138 NYSE Stocks In 2003,
For Market Orders (The NYSE And Electronic Markets)**



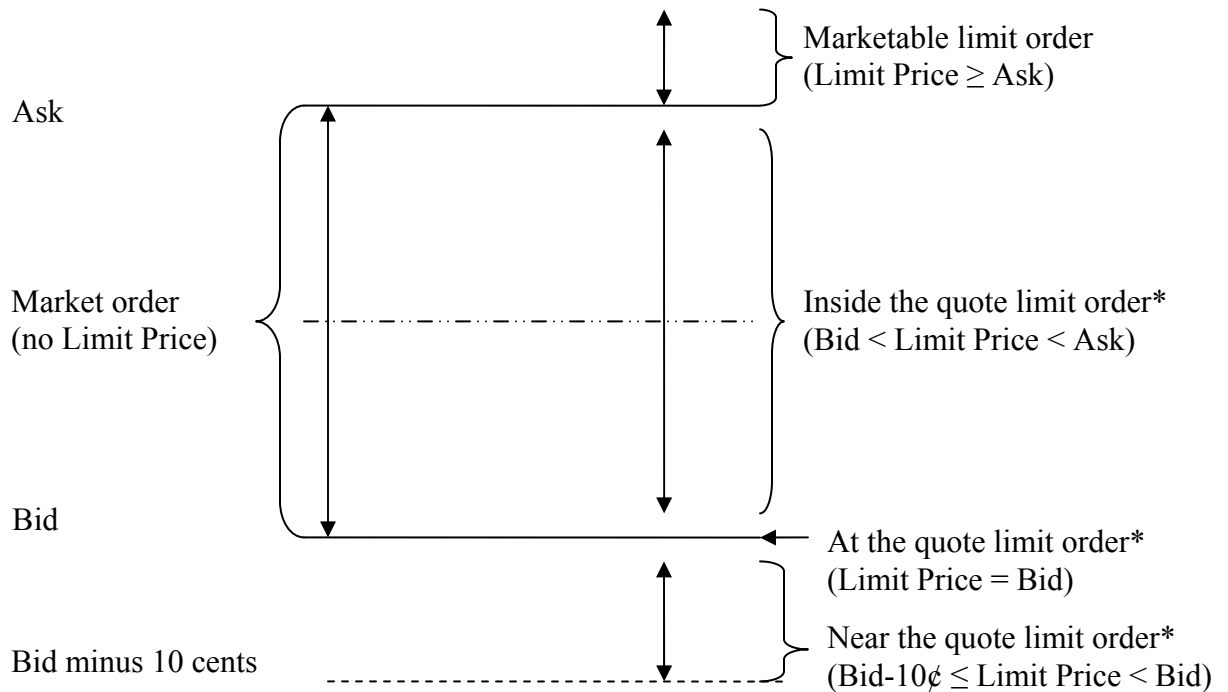
**Figure VI - Quoted Spreads Versus Effective Spreads
For Market Orders On The NYSE and Electronic Markets**



Appendix I

Definitions

The following illustration is for buy orders.



*: These are labeled as “non-marketable” limit orders.

$$Effective\ Spread = 2 \times \left(Execution\ price - \frac{Ask + Bid}{2} \right)$$

Appendix II

Orders Covered in Dash-5 Reports

The definition of "covered order" in Rule 11Ac1-5 contains several conditions and exclusions that are intended to limit its scope to those orders that provide a basis for meaningful and comparable statistical measures of execution quality.

- The Rule applies only to market orders or limit orders that are received by a market center during regular trading hours of 09:30 AM to 04:00 PM ET and, if executed, executed during such time.
- Covered orders must be received during the time that a consolidated BBO is being disseminated.
- The definition of covered order excludes any orders for which the customer requested special handling for execution. Types of orders specifically excluded from the Rule include, but are not limited to,
 - orders to be executed at a market opening or closing price, stop orders, orders such as short sales that must be executed on a particular tick or bid, orders submitted on a "not held" basis, orders for other than regular settlement, and orders to be executed at prices unrelated to the market price at the time of execution.
 - In addition, the Rule specifically excludes all-or-none orders on the basis that they often may be more difficult to execute than orders without a substantial minimum quantity requirement
- Immediate-or-cancel orders are included in the Rule. Orders to be executed at a market opening price - is excluded
- The Commission temporarily exempts orders received by a market center otherwise than through automated systems.
- The Commission has exempted from the Rule any order with a size of 10,000 shares or greater.

Appendix III

General Filters

| | |
|--|-------------|
| All securities on 12/31/2002 | 2557 |
| + Single class | 2355 |
| + Ordinary common stock which need not be further defined | 1329 |
| + not “no price on 12/31/2002” | 1329 |
| + not “no SIC code on 12/31/2002” | 1328 |
| + no “missing daily price during 01/01/2001 and 12/31/2003” | 1218 |
| + no switch | 1204 |
| + mean daily trading volume \geq \$20,000 | 1192 |
| + no missing daily volume, any day during the fourth quarter of 2002 | 1192 |
| + no daily price during the fourth quarter of 2002 < \$3.00 | 1111 |
| + no change exchange | 1108 |
| Total symbols | 1116 |

Take back these symbols

| | |
|--|---|
| Top 10% of market capitalization on 2002/12/31 | 19 (out of 343) |
| Top 10% of average daily volume during the fourth quarter of 2002 | 18 (out of 135) |
| Top 10% of average daily dollar volume during the fourth quarter of 2002 | 8 (out of 135) |
| Total final symbols | 1146 |
| For dash 5 data | 1142 (no records for NMG, CCR, PZL, KM) |
| Exclude those without full year’s data | 1138 (HI, MIR, PHA, UAL) |

Appendix IV

Final List of 1,138 NYSE Symbols

| | | | |
|-----|----------------------------------|-----|----------------------------------|
| A | AGILENT TECHNOLOGIES INC | LEN | LENNAR CORP |
| AA | ALCOA INC | LFB | LONGVIEW FIBRE CO |
| ABI | APPLERA CORP | LFG | LANDAMERICA FINANCIAL GROUP INC |
| ABK | AMBAC FINANCIAL GROUP INC | LG | LACLEDE GROUP INC |
| ABM | A B M INDUSTRIES INC | LH | LABORATORY CORP AMERICA HLDGS |
| ABS | ALBERTSONS INC | LII | LENNOX INTERNATIONAL INC |
| ABT | ABBOTT LABS | LIN | LINENS N THINGS INC |
| ACF | AMERICREDIT CORP | LIZ | LIZ CLAIBORNE INC |
| ACI | ARCH COAL INC | LLL | L 3 COMMUNICATIONS HLDGS INC |
| ACO | AMCOL INTERNATIONAL CORP | LLY | LILLY ELI & CO |
| AD | ADVO INC | LM | LEGG MASON INC |
| ADI | ANALOG DEVICES INC | LMT | LOCKHEED MARTIN CORP |
| ADM | ARCHER DANIELS MIDLAND CO | LNC | LINCOLN NATIONAL CORP IN |
| ADP | AUTOMATIC DATA PROCESSING INC | LNN | LINDSAY MANUFACTURING CO |
| AEE | AMEREN CORP | LNR | L N R PROPERTY CORP |
| AEP | AMERICAN ELECTRIC POWER INC | LNT | ALLIANT ENERGY CORP |
| AET | AETNA INC NEW | LNK | LANDRYS RESTAURANTS INC |
| AF | ASTORIA FINANCIAL CORP | LOW | LOWES COMPANIES INC |
| AFC | ALLMERICA FINANCIAL CORP | LPX | LOUISIANA PACIFIC CORP |
| AFG | AMERICAN FINANCIAL GROUP INC NEW | LQI | LA QUINTA CORP |
| AFL | A F L A C INC | LRW | LABOR READY INC |
| AG | A G C O CORP | LSI | L S I LOGIC CORP |
| AGE | EDWARDS A G INC | LSS | LONE STAR TECHNOLOGIES INC |
| AGL | ANGELICA CORP | LTD | LIMITED BRANDS INC |
| AGN | ALLERGAN INC | LTR | LOEWS CORP |
| AGY | ARGOSY GAMING CO | LUK | LEUCADIA NATIONAL CORP |
| AH | ARMOR HOLDINGS INC | LUV | SOUTHWEST AIRLINES CO |
| AHC | AMERADA HESS CORP | LVB | STEINWAY MUSICAL INSTRUMENTS INC |
| AHG | APRIA HEALTHCARE GROUP INC | LYO | LYONDELL CHEMICAL CO |
| AIG | AMERICAN INTERNATIONAL GROUP INC | LZ | LUBRIZOL CORP |
| AIR | A A R CORP | LZB | LA Z BOY INC |
| AIT | APPLIED INDUSTRIAL TECHS INC | MAG | MAGNETEK INC |
| AJG | GALLAGHER ARTHUR J & CO | MAS | MASCO CORP |
| AKS | A K STEEL HOLDING CORP | MAT | MATTEL INC |
| ALB | ALBEMARLE CORP | MAY | MAY DEPARTMENT STORES CO |
| ALD | ALLIED CAPITAL CORP NEW | MBG | MANDALAY RESORT GROUP |
| ALE | ALLETE | MBI | M B I A INC |
| ALG | ALAMO GROUP INC | MCC | MESTEK INC |
| ALK | ALASKA AIRGROUP INC | MCD | MCDONALDS CORP |
| ALL | ALLSTATE CORP | MCH | MILLENIUM CHEMICALS INC |
| AMD | ADVANCED MICRO DEVICES INC | MCK | MCKESSON H B O C INC |
| AME | AMETEK INC NEW | MCO | MOODYS CORP |
| AMG | AFFILIATED MANAGERS GROUP INC | MCS | MARCUS CORP |
| AMH | AMERUS GROUP CO | MCY | MERCURY GENERAL CORP NEW |
| AMN | AMERON INTERNATIONAL CORP DEL | MDC | M D C HOLDINGS INC |
| AMR | A M R CORP DEL | MDP | MEREDITH CORP |
| AMZ | AMERICAN MEDICAL SECURITY GR INC | MDS | MIDAS INC |

| | | | |
|-----|-------------------------------|-----|---------------------------------|
| AN | AUTONATION INC DEL | MDT | MEDTRONIC INC |
| ANN | ANNTAYLOR STORES CORP | MDU | M D U RESOURCES GROUP INC |
| ANS | AIRNET SYSTEMS INC | MEE | MASSEY ENERGY CO |
| AOC | AON CORP | MEH | MIDWEST EXPRESS HOLDINGS INC |
| AOL | A O L TIME WARNER INC | MEL | MELLON FINANCIAL CORP |
| AOS | SMITH A O CORP | MER | MERRILL LYNCH & CO INC |
| AOT | APOGENT TECHNOLOGIES INC | MET | METLIFE INC |
| AP | AMPCO PITTSBURGH CORP | MFW | M & F WORLDWIDE CORP |
| APA | APACHE CORP | MGG | M G M MIRAGE |
| APC | ANADARKO PETROLEUM CORP | MGM | METRO GOLDWYN MAYER INC NEW |
| APD | AIR PRODUCTS & CHEMICALS INC | MHK | MOHAWK INDUSTRIES INC |
| APH | AMPHENOL CORP NEW | MHO | M I SCHOTTENSTEIN HOMES INC NEW |
| APN | APPLICA INC | MHP | MCGRAW HILL COS INC |
| ARG | AIRGAS INC | MHR | MAGNUM HUNTER RESOURCES INC |
| ARJ | ARCH CHEMICALS INC | MI | MARSHALL & ILSLEY CORP |
| ARM | ARVINMERITOR INC | MIK | MICHAELS STORES INC |
| ARW | ARROW ELECTRONICS INC | MIL | MILLIPORE CORP |
| ASF | ADMINISTAFF INC | MKC | MCCORMICK & CO INC |
| ASH | ASHLAND INC | MKL | MARKEL CORP |
| ASO | AMSOUTH BANCORPORATION | MKT | ADVANCED MARKETING SERVICES INC |
| ASV | AG SERVICES OF AMERICA INC | MLI | MUELLER INDUSTRIES INC |
| AT | ALLTEL CORP | MLM | MARTIN MARIETTA MATERIALS INC |
| ATG | A G L RESOURCES INC | MMA | MUNICIPAL MORTGAGE & EQUITY LLC |
| ATI | ALLEGHENY TECHNOLOGIES | MMC | MARSH & MCLENNAN COS INC |
| ATK | ALLIANT TECHSYSTEMS INC | MME | MID ATLANTIC MEDICAL SVCS INC |
| ATN | ACTION PERFORMANCE COS INC | MMM | 3M CO |
| ATO | ATMOS ENERGY CORP | MMS | MAXIMUS INC |
| ATR | APTARGROUP INC | MNC | MONACO COACH CORP |
| ATW | ATWOOD OCEANICS INC | MNS | M S C SOFTWARE CORP |
| AVA | AVISTA CORP | MNY | MONY GROUP INC |
| AVL | AVIALL INC NEW | MO | ALTRIA GROUP INC |
| AVP | AVON PRODUCTS INC | MON | MONSANTO CO NEW |
| AVT | AVNET INC | MOT | MOTOROLA INC |
| AVX | A V X CORP NEW | MOV | MOVADO GROUP INC |
| AVY | AVERY DENNISON CORP | MPR | MET PRO CORP |
| AW | ALLIED WASTE INDUSTRIES INC | MPS | M P S GROUP INC |
| AWR | AMERICAN STATES WATER CO | MRD | MACDERMID INC |
| AXE | ANIXTER INTERNATIONAL INC | MRK | MERCK & CO INC |
| AXL | AMERICAN AXLE & MFG HLGDS INC | MRO | MARATHON OIL CORP |
| AXP | AMERICAN EXPRESS CO | MSC | MATERIAL SCIENCES CORP |
| AYE | ALLEGHENY ENERGY INC | MTB | M & T BANK CORP |
| AZO | AUTOZONE INC | MTG | M G I C INVESTMENT CORP WIS |
| AZR | AZTAR CORP | MTH | MERITAGE CORPORATION |
| AZZ | A Z Z INC | MTN | VAIL RESORTS INC |
| B | BARNES GROUP INC | MTW | MANITOWOC INC |
| BA | BOEING CO | MTX | MINERALS TECHNOLOGIES INC |
| BAC | BANK OF AMERICA CORP | MU | MICRON TECHNOLOGY INC |
| BAX | BAXTER INTERNATIONAL INC | MUR | MURPHY OIL CORP |
| BBI | BLOCKBUSTER INC | MVK | MAVERICK TUBE CORP |
| BBR | BUTLER MANUFACTURING CO DE | MVL | MARVEL ENTERPRISES INC |

| | | | |
|-----|----------------------------------|-----|----------------------------------|
| BBT | B B & T CORP | MW | MENS WAREHOUSE INC |
| BBY | BEST BUY COMPANY INC | MWD | MORGAN STANLEY DEAN WITTER & CO |
| BC | BRUNSWICK CORP | MWV | MEADWESTVACO CORP |
| BCC | BOISE CASCADE CORP | MWY | MIDWAY GAMES INC |
| BCF | BURLINGTON COAT FACTORY | MYE | MYERS INDUSTRIES INC |
| BCO | BRINKS CO | MYG | MAYTAG CORP |
| BCR | BARD C R INC | MYL | MYLAN LABS INC |
| BDG | BANDAG INC | MZ | MILACRON INC |
| BDK | BLACK & DECKER CORP | NAP | NATIONAL PROCESSING INC |
| BDX | BECTON DICKINSON & CO | NAV | NAVISTAR INTERNATIONAL CORP |
| BEC | BECKMAN COULTER INC | NBL | NOBLE ENERGY INC |
| BEN | FRANKLIN RESOURCES INC | NCC | NATIONAL CITY CORP |
| BER | BERKLEY W R CORP | NCF | NATIONAL COMMERCE FINANCIAL CORP |
| BEZ | BALDOR ELECTRIC CO | NCI | NAVIGANT CONSULTING INC |
| BFT | BALLY TOTAL FITNESS HOLDING CORP | NCR | N C R CORP NEW |
| BGG | BRIGGS & STRATTON CORP | NCS | N C I BUILDING SYSTEMS INC |
| BGP | BORDERS GROUP INC | NDC | NDC HEALTH CORP |
| BHE | BENCHMARK ELECTRONICS INC | NDE | INDYMAC BANCORP INC |
| BHI | BAKER HUGHES INC | NDN | 99 CENTS ONLY STORES |
| BJ | B J S WHOLESALE CLUB INC | NEB | NEW ENGLAND BUSINESS SVC INC |
| BJS | B J SERVICES CO | NEM | NEWMONT MINING CORP |
| BK | BANK NEW YORK INC | NET | NETWORKS ASSOCIATES INC |
| BKE | BUCKLE INC | NEV | NUEVO ENERGY CO |
| BKH | BLACK HILLS CORP | NFB | NORTH FORK BANCORPORATION NY INC |
| BKI | BUCKEYE TECHNOLOGIES INC | NFG | NATIONAL FUEL GAS CO N J |
| BKS | BARNES & NOBLE INC | NFX | NEWFIELD EXPLORATION CO |
| BLI | BIG LOTS INC | NI | NISOURCE INC |
| BLK | BLACKROCK INC | NJR | NEW JERSEY RES |
| BLL | BALL CORP | NL | N L INDUSTRIES INC |
| BLS | BELLSOUTH CORP | NLS | NAUTILUS GROUP INC |
| BMC | B M C SOFTWARE INC | NOC | NORTHROP GRUMMAN CORP |
| BMS | BEMIS INC | NOI | NATIONAL OILWELL INC |
| BMY | BRISTOL MYERS SQUIBB CO | NPK | NATIONAL PRESTO INDS INC |
| BN | BANTA CORP | NSC | NORFOLK SOUTHERN CORP |
| BNE | BOWNE & CO INC | NSH | NASHUA CORP |
| BNI | BURLINGTON NORTHERN SANTA FE CP | NSM | NATIONAL SEMICONDUCTOR CORP |
| BOH | BANK OF HAWAII CORP | NSS | N S GROUP INC |
| BOL | BAUSCH & LOMB INC | NST | NSTAR |
| BOW | BOWATER INC | NTG | NATCO GROUP INC |
| BR | BURLINGTON RESOURCES INC | NU | NORTHEAST UTILITIES |
| BRL | BARR LABORATORIES INC | NUE | NUCOR CORP |
| BRO | BROWN & BROWN INC | NUI | N U I CORP NEW |
| BSC | BEAR STEARNS COS INC | NVH | NATIONAL R V HOLDINGS INC |
| BSG | BISYS GROUP INC | NWL | NEWELL RUBBERMAID INC |
| BSX | BOSTON SCIENTIFIC CORP | NWN | NORTHWEST NATURAL GAS CO |
| BTH | BLYTH INC | NX | QUANEX CORP |
| BUD | ANHEUSER BUSCH COS INC | NYM | N Y M A G I C INC |
| BVC | BAY VIEW CAPITAL CORP | OCA | ORTHODONTIC CENTERS OF AMER INC |
| BW | BRUSH WELLMAN INC | OCQ | ONEIDA LTD |
| BWA | BORGWARNER INC | OCR | OMNICARE INC |

| | | | |
|-----|----------------------------------|-----|---------------------------------|
| BWC | BELDEN INC | ODC | OIL DRI CORP OF AMERICA |
| BWS | BROWN SHOE INC NEW | ODP | OFFICE DEPOT INC |
| BXG | BLUEGREEN CORP | OFG | ORIENTAL FINANCIAL GROUP INC |
| BXS | BANCORPSOUTH INC | OGE | O G E ENERGY CORP |
| BYD | BOYD GAMING CORP | OHP | OXFORD HEALTH PLANS INC |
| BZH | BEAZER HOMES USA INC | OI | OWENS ILL INC |
| C | CITIGROUP INC | OII | OCEANEERING INTERNATIONAL INC |
| CA | COMPUTER ASSOCIATES INTL INC | OKE | ONEOK INC NEW |
| CAE | CASCADE CORP | OLN | OLIN CORP |
| CAG | CONAGRA INC | OMC | OMNICOM GROUP INC |
| CAH | CARDINAL HEALTH INC | OME | OMEGA PROTEIN CORP |
| CAM | COOPER CAMERON CORP | OMG | O M GROUP INC |
| CAO | C S K AUTO CORP | OMI | OWENS & MINOR INC NEW |
| CAT | CATERPILLAR INC | OMN | OMNOVA SOLUTIONS INC |
| CB | CHUBB CORP | ONB | OLD NATIONAL BANCORP |
| CBC | CLARK BARDES INC | ONE | BANK ONE CORP |
| CBH | COMMERCE BANCORP INC NJ | OO | OAKLEY INC |
| CBK | CHRISTOPHER AND BANKS CORP | ORI | OLD REPUBLIC INTERNATIONAL CORP |
| CBM | CAMBREX CORP | OS | OREGON STEEL MILLS INC |
| CBR | CIBER INC | OSG | OVERSEAS SHIPHOLDING GROUP INC |
| CBT | CABOT CORP | OSI | OUTBACK STEAKHOUSE INC |
| CBU | COMMUNITY BANK SYSTEM INC | OSK | OSHKOSH TRUCK CORP |
| CC | CIRCUIT CITY STORES INC | OXM | OXFORD INDUSTRIES INC |
| CCC | CALGON CARBON CORP | OXY | OCCIDENTAL PETROLEUM CORP |
| CCE | COCA COLA ENTERPRISES INC | PAS | PEPSIAMERICAS INC |
| CCK | CROWN CORK & SEAL INC | PBG | PEPSI BOTTLING GROUP INC |
| CCU | CLEAR CHANNEL COMMUNICATIONS INC | PBI | PITNEY BOWES INC |
| CD | CENDANT CORP | PBY | PEP BOYS MANNY MOE & JACK |
| CDI | C D I CORP | PCG | P G & E CORP |
| CDN | CADENCE DESIGN SYSTEMS INC | PCH | POTLATCH CORP |
| CDT | CABLE DESIGN TECHNOLOGIES CORP | PCP | PRECISION CASTPARTS CORP |
| CDX | CATELLUS DEVELOPMENT CORP | PCU | SOUTHERN PERU COPPER CORP |
| CEC | C E C ENTERTAINMENT INC | PD | PHELPS DODGE CORP |
| CEG | CONSTELLATION ENERGY GROUP INC | PDE | PRIDE INTERNATIONAL INC DEL |
| CEN | CERIDIAN CORP NEW | PDQ | PRIME HOSPITALITY CORP |
| CF | CHARTER ONE FINANCIAL INC | PDX | PEDIATRIX MEDICAL GROUP |
| CFB | COMMERCIAL FEDERAL CORP | PEG | PUBLIC SERVICE ENTERPRISE GROUP |
| CFC | COUNTRYWIDE FINANCIAL CORP | PEP | PEPSICO INC |
| CFI | CULP INC | PFB | P F F BANCORP INC |
| CFR | CULLEN FROST BANKERS INC | PFE | PFIZER INC |
| CGC | CASCADE NATURAL GAS CORP | PG | PROCTER & GAMBLE CO |
| CGI | COMMERCE GROUP INC MASS | PGL | PEOPLES ENERGY CORP |
| CGX | CONSOLIDATED GRAPHICS INC | PGN | PROGRESS ENERGY INC |
| CHD | CHURCH & DWIGHT INC | PGR | PROGRESSIVE CORP OH |
| CHE | CHEMED CORP | PH | PARKER HANNIFIN CORP |
| CHG | C H ENERGY GROUP INC | PHM | PULTE HOMES INC |
| CHH | CHOICE HOTELS INTERNATIONAL INC | PIK | WATER PIK TECHNOLOGIES |
| CHK | CHESAPEAKE ENERGY CORP | PIR | PIER 1 IMPORTS INC DE |
| CHP | C & D TECHNOLOGIES INC | PKE | PARK ELECTROCHEMICAL CORP |
| CHS | CHICOS FAS INC | PKG | PACKAGING CORP AMERICA |

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| CHX | PILGRIMS PRIDE CORP | PKI | PERKINELMER INC |
| CHZ | CHITTENDEN CORP | PKS | SIX FLAGS INC |
| CI | C I G N A CORP | PL | PROTECTIVE LIFE CORP |
| CIN | CINERGY CORP | PLL | PALL CORP |
| CK | CROMPTON CORP | PLT | PLANTRONICS INC NEW |
| CKH | SEACOR SMIT INC | PLX | PLAINS RESOURCES INC |
| CKP | CHECKPOINT SYSTEMS INC | PMI | P M I GROUP INC |
| CKR | C K E RESTAURANTS INC | PNC | P N C FINANCIAL SERVICES GRP INC |
| CL | COLGATE PALMOLIVE CO | PNG | PENN AMERICA GROUP INC |
| CLC | CLARCOR INC | PNK | PINNACLE ENTERTAINMENT GROUP INC |
| CLE | CLAIRES STORES INC | PNM | P N M RESOURCES INC |
| CLF | CLEVELAND CLIFFS INC | PNN | PENN ENGINEERING & MFG CORP |
| CLK | CLARK INC | PNR | PENTAIR INC |
| CLX | CLOROX CO | PNW | PINNACLE WEST CAPITAL CORP |
| CMA | COMERICA INC | PNY | PIEDMONT NATURAL GAS INC |
| CMC | COMMERCIAL METALS CO | POG | PATINA OIL & GAS CORP |
| CMI | CUMMINS INC | POL | POLYONE CORP |
| CMN | CANTEL MEDICAL CORP | POM | PEPCO HOLDINGS INC |
| CMS | C M S ENERGY CORP | POP | POPE & TALBOT INC |
| CMX | CAREMARK RX INC | POS | CATALINA MARKETING CORP |
| CNA | C N A FINANCIAL CORP | PPC | PILGRIMS PRIDE CORP |
| CNB | COLONIAL BANCGROUP INC | PPD | PRE PAID LEGAL SERVICES INC |
| CNF | C N F INC | PPE | PARK PLACE ENTERTAINMENT CORP |
| CNL | CLECO CORP NEW | PPG | P P G INDUSTRIES INC |
| CNP | CENTERPOINT ENERGY INC | PPL | P P L CORP |
| CNX | CONSOL ENERGY INC | PPP | POGO PRODUCING CO |
| COA | COACHMEN INDUSTRIES INC | PQE | PROQUEST CO |
| COF | CAPITAL ONE FINANCIAL CORP | PR | PRICE COMMUNICATIONS CORP |
| COG | CABOT OIL & GAS CORP | PRA | PROASSURANCE CORP |
| COH | COACH INC | PRV | PROVINCE HEALTHCARE CO |
| COO | COOPER COMPANIES INC | PRX | PHARMACEUTICAL RESOURCES INC |
| COP | CONOCOPHILLIPS | PSC | PHILADELPHIA SUBURBAN CORP |
| CPB | CAMPBELL SOUP CO | PSD | PUGET ENERGY INC |
| CPC | CENTRAL PARKING CORP | PSS | PAYLESS SHOESOURCE INC |
| CPE | CALLON PETROLEUM CO DEL | PTC | PAR TECHNOLOGY CORP |
| CPK | CHESAPEAKE UTILITIES CORP | PTV | PACTIV CORP |
| CPO | CORN PRODUCTS INTERNATIONAL INC | PTZ | PULITZER INC |
| CPS | CHOICEPOINT INC | PVA | PENN VIRGINIA CORP |
| CPY | C P I CORP | PVH | PHILLIPS VAN HEUSEN CORP |
| CR | CRANE CO | PVN | PROVIDIAN FINANCIAL CORP |
| CRA | APPLERA CORP | PWN | CASH AMERICA INTERNATIONAL INC |
| CRK | COMSTOCK RESOURCES INC | PX | PRAXAIR INC |
| CRL | CHARLES RIVER LABS INTL INC | PXD | PIONEER NATURAL RESOURCES CO |
| CRN | CORNELL COMPANIES INC | PXR | PAXAR CORP |
| CRR | CARBO CERAMICS INC | PYX | PLAYTEX PRODUCTS INC |
| CRS | CARPENTER TECHNOLOGY CORP | PZB | PITTSTON COMPANY |
| CSC | COMPUTER SCIENCES CORP | R | RYDER SYSTEMS INC |
| CSK | CHESAPEAKE CORP VA | RAH | RALCORP HOLDINGS INC NEW |
| CSL | CARLISLE COMPANIES | RAY | RAYTECH CORP DE |
| CSS | C S S INDUSTRIES INC | RBK | REEBOK INTERNATIONAL LTD |

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| CSV | CARRIAGE SERVICES INC | RBN | ROBBINS & MYERS INC |
| CSX | C S X CORP | RCI | RENAL CARE GROUP INC |
| CTB | COOPER TIRE & RUBBER CO | RDC | ROWAN COMPANIES INC |
| CTL | CENTURYTEL INC | RDK | RUDDICK CORP |
| CTS | C T S CORP | RDN | RADIAN GROUP INC |
| CTV | COMMSCOPE INC | REM | REMINGTON OIL & GAS CORP |
| CTX | CENTEX CORP | RES | R P C INC |
| CUM | CUMMINS INC | RF | REGIONS FINANCIAL CORP |
| CV | CENTRAL VERMONT PUB SVC CORP | RGA | REINSURANCE GROUP OF AMERICA INC |
| CVD | COVANCE INC | RGB | BARRY R G CORP OHIO |
| CVG | CONVERGYS CORP | RGR | STURM RUGER & CO INC |
| CVH | COVENTRY HEALTH CARE INC | RHB | REHABCARE GROUP INC |
| CVS | C V S CORP | RHD | R H DONNELLEY CORP |
| CVX | CHEVRONTEXACO CORP | RHI | ROBERT HALF INTERNATIONAL INC |
| CW | CURTISS WRIGHT CORP | RI | RUBY TUESDAY INC |
| CWT | CALIFORNIA WATER SERVICE GROUP | RJF | RAYMOND JAMES FINANCIAL INC |
| CXP | CENTEX CONSTRUCTION PRODUCTS INC | RJR | REYNOLDS R J TOBACCO HLDGS INC |
| CY | CYPRESS SEMICONDUCTOR CORP | RKY | COORS ADOLPH CO |
| CYH | COMMUNITY HEALTH SYS INC NEW | RLI | R L I CORP |
| CYN | CITY NATIONAL CORP | RMD | RESMED INC |
| CYT | CYTEC INDUSTRIES INC | RML | RUSSELL CORP |
| CZN | CITIZENS COMMUNICATIONS CO | RNT | AARON RENTS INC |
| D | DOMINION RESOURCES INC VA NEW | ROG | ROGERS CORP |
| DAB | DAVE & BUSTERS INC | ROH | ROHM & HAAS CO |
| DAL | DELTA AIR LINES INC | ROK | ROCKWELL AUTOMATION INC |
| DBD | DIEBOLD INC | ROL | ROLLINS INC |
| DCI | DONALDSON INC | ROP | ROPER INDUSTRIES INC NEW |
| DCN | DANA CORP | ROV | RAYOVAC CORP |
| DCO | DUCOMMUN INC DE | RPM | R P M INTERNATIONAL INC |
| DD | DU PONT E I DE NEMOURS & CO | RRA | RAILAMERICA INC |
| DE | DEERE & CO | RRC | RANGE RESOURCES CORP |
| DEL | DELTIC TIMBER CORP | RRR | ROTO ROOTER INC NEW |
| DF | DEAN FOODS CO NEW | RS | RELIANCE STEEL & ALUMINUM CO |
| DFS | DEPARTMENT 56 INC | RSC | REX STORES CORP |
| DG | DOLLAR GENERAL CORP | RSG | REPUBLIC SERVICES INC |
| DGX | QUEST DIAGNOSTICS INC | RSH | RADIOSHACK CORP |
| DHI | D R HORTON INC | RST | BOCA RESORTS INC |
| DHR | DANAHER CORP | RT | RYERSON TULL INC NEW |
| DIS | DISNEY WALT CO | RTI | R T I INTERNATIONAL METALS INC |
| DJ | DOW JONES & CO INC | RUS | RUSS BERRIE & CO |
| DL | DIAL CORP NEW | RX | I M S HEALTH INC |
| DLM | DEL MONTE FOODS CO | RYL | RYLAND GROUP INC A |
| DLX | DELUXE CORP | RYN | RAYONIER INC |
| DMN | DIMON INC | S | SEARS ROEBUCK & CO |
| DNA | GENENTECH INC | SAH | SONIC AUTOMOTIVE INC |
| DNB | DUN & BRADSTREET CORP DEL NEW | SBC | S B C COMMUNICATIONS INC |
| DNR | DENBURY RESOURCES INC | SBL | SYMBOL TECHNOLOGIES INC |
| DNY | DONNELLEY R R & SONS CO | SCG | SCANA CORP NEW |
| DO | DIAMOND OFFSHORE DRILLING INC | SCH | SCHWAB CHARLES CORP NEW |
| DOV | DOVER CORP | SCL | STEPAN CO |

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| DOW | DOW CHEMICAL CO | SDS | SUNGARD DATA SYSTEMS INC |
| DP | DIAGNOSTIC PRODUCTS CORP | SE | 7 ELEVEN INC |
| DPH | DELPHI CORP | SEE | SEALED AIR CORP NEW |
| DPL | D P L INC | SEH | SPARTECH CORP |
| DQE | D Q E INC | SEN | SEMCO ENERGY INC |
| DRD | DUANE READE INC | SF | STIFEL FINANCIAL CORP |
| DRQ | DRIL QUIP INC | SFA | SCIENTIFIC ATLANTA INC |
| DRS | D R S TECHNOLOGIES INC | SFD | SMITHFIELD FOODS INC |
| DSL | DOWNEY FINANCIAL CORP | SFG | STANCORP FINANCIAL GROUP INC |
| DST | D S T SYSTEMS INC DEL | SFN | SPHERION CORP |
| DTE | D T E ENERGY CO | SFP | SALTON INC |
| DTG | DOLLAR THRIFTY AUTOMOTIVE GRP IN | SFY | SWIFT ENERGY CO |
| DUK | DUKE ENERGY CORP | SGP | SCHERING PLOUGH CORP |
| DV | DEVRY INC DEL | SGR | SHAW GROUP INC |
| DVA | DAVITA INC | SGY | STONE ENERGY CORP |
| DVD | DOVER MOTORSPORTS INC | SHS | SAUER DANFOSS INC |
| DY | DYCOM INDUSTRIES INC | SHW | SHERWIN WILLIAMS CO |
| EAS | ENERGY EAST CORP | SIB | STATEN ISLAND BANCORP INC |
| EAT | BRINKER INTERNATIONAL INC | SIE | SIERRA HEALTH SERVICES INC |
| EBF | ENNIS BUSINESS FORMS INC | SII | SMITH INTERNATIONAL INC |
| EC | ENGELHARD CORP | SJI | SOUTH JERSEY INDS INC |
| ECL | ECOLAB INC | SJM | SMUCKER J M CO |
| ED | CONSOLIDATED EDISON INC | SKE | SPINNAKER EXPLORATION CO |
| EDE | EMPIRE DISTRICT ELEC CO | SKO | SHOPKO STORES INC |
| EDO | EDO CORP | SKP | S C P I E HOLDINGS INC |
| EDS | ELECTRONIC DATA SYS CORP NEW | SKS | SAKS INC |
| EFX | EQUIFAX INC | SKY | SKYLINE CORP |
| EGN | ENERGEN CORP | SLE | SARA LEE CORP |
| EIX | EDISON INTERNATIONAL | SLM | S L M CORP |
| EK | EASTMAN KODAK CO | SMF | SMART & FINAL INC |
| ELK | ELKCORP | SMP | STANDARD MOTOR PRODUCTS INC |
| ELX | EMULEX CORP | SNA | SNAP ON INC |
| ELY | CALLAWAY GOLF CO | SNS | STEAK N SHAKE CO |
| EMC | E M C CORP MA | SNV | SYNOVUS FINANCIAL CORP |
| EME | EMCOR GROUP INC | SO | SOUTHERN CO |
| EMN | EASTMAN CHEMICAL CO | SON | SONOCO PRODUCTS CO |
| EMR | EMERSON ELECTRIC CO | SOV | SOVEREIGN BANCORP INC |
| ENC | ENESCO GROUP INC | SP | SPECIALTY LABORATORIES INC |
| ENR | ENERGIZER HOLDINGS INC | SPC | ST PAUL COS INC |
| ENZ | ENZO BIOCHEM INC | SPF | STANDARD PACIFIC CORP NEW |
| EOG | EOG RESOURCES INC | SPN | SUPERIOR ENERGY SERVICES INC |
| EP | EL PASO CORP | SPW | S P X CORP |
| EPL | ENERGY PARTNERS LTD | SR | STANDARD REGISTER CO |
| EQT | EQUITABLE RESOURCES INC | SRE | SEMPRA ENERGY |
| ESA | EXTENDED STAY AMERICA INC | SRI | STONERIDGE INC |
| ESE | E S C O TECHNOLOGIES INC | SRP | SIERRA PACIFIC RESOURCES NEW |
| ESI | I T T EDUCATIONAL SERVICES INC | SRR | STRIDE RITE CORP |
| ESL | ESTERLINE TECHNOLOGIES CORP | SRT | STARTEK INC |
| ESV | E N S C O INTERNATIONAL INC | SRZ | SUNRISE ASSISTED LIVING INC |
| ET | E TRADE GROUP INC | SSD | SIMPSON MANUFACTURING INC |

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| ETH | ETHAN ALLEN INTERIORS INC | STC | STEWART INFORMATION SVCS CORP |
| ETM | ENTERCOM COMMUNICATIONS CORP | STE | STERIS CORP |
| ETN | EATON CORP | STI | SUNTRUST BANKS INC |
| ETR | ENTERGY CORP NEW | STJ | ST JUDE MEDICAL INCA |
| EV | EATON VANCE CORP | STK | STORAGE TECHNOLOGY CORP |
| EVG | EVERGREEN RESOURCES INC | STL | STERLING BANCORP |
| EW | EDWARDS LIFESCIENCES CORP | STN | STATION CASINOS INC |
| EXC | EXELON CORP | STR | QUESTAR CORP |
| EYE | V I S X INC | STT | STATE STREET CORP |
| F | FORD MOTOR CO DEL | STU | STUDENT LOAN CORP |
| FAF | FIRST AMERICAN CORP CALIF | STW | STANDARD COMMERCIAL CORP |
| FBC | FLAGSTAR BANCORP INC | SUG | SOUTHERN UNION CO NEW |
| FBF | FLEETBOSTON FINANCIAL CORP | SUN | SUNOCO INC |
| FBN | FURNITURE BRANDS INTL INC | SUP | SUPERIOR INDUSTRIES INTL INC |
| FBP | FIRST BANCORP P R | SUR | C N A SURETY CORP |
| FCF | FIRST COMMONWEALTH FINANCIAL COR | SVM | SERVICEMASTER CO |
| FCN | F T I CONSULTING INC | SVU | SUPERVALU INC |
| FCP | FALCON PRODUCTS INC | SWC | STILLWATER MINING CO |
| FD | FEDERATED DEPT STORES INC DEL | SWK | STANLEY WORKS |
| FDC | FIRST DATA CORP | SWM | SCHWEITZER MAUDUIT INTL INC |
| FDO | FAMILY DOLLAR STORES INC | SWN | SOUTHWESTERN ENERGY CO |
| FDS | FACTSET RESEARCH SYSTEMS INC | SWS | S W S GROUP INC |
| FDX | FEDEX CORP | SWX | SOUTHWEST GAS CORP |
| FE | FIRSTENERGY CORP | SWY | SAFEWAY INC |
| FED | FIRSTFED FINANCIAL CORP | SXI | STANDEX INTERNATIONAL CORP |
| FIC | FAIR ISAAC & CO INC | SXT | SENSIENT TECHNOLOGIES CORP |
| FIF | FINANCIAL FEDERAL CORP | SY | SYBASE INC |
| FL | FOOT LOCKER INC | SYD | SYBRON DENTAL SPECIALTIES INC |
| FLE | FLEETWOOD ENTERPRISES INC | SYK | STRYKER CORP |
| FLR | FLUOR CORP NEW | SYM | SYMS CORP |
| FLS | FLOWSERVE CORP | SYY | SYSCO CORP |
| FMC | F M C CORP | T | A T & T CORP |
| FMT | FREMONT GENERAL CORP | TBC | TASTY BAKING CO |
| FNF | FIDELITY NATIONAL FINANCIAL INC | TBI | BROWN TOM INC |
| FNM | FEDERAL NATIONAL MORTGAGE ASSN | TCB | T C F FINANCIAL CORP |
| FO | FORTUNE BRANDS INC | TCC | TRAMMELL CROW CO |
| FOB | BOYDS COLLECTION LTD | TDI | TWIN DISC INC |
| FOE | FERRO CORP | TDW | TIDEWATER INC |
| FON | SPRINT CORP | TDY | TELEDYNE TECHNOLOGIES |
| FPL | F P L GROUP INC | TE | T E C O ENERGY INC |
| FRC | FIRST REPUBLIC BANK S F | TEK | TEKTRONIX INC |
| FRE | FEDERAL HOME LOAN MORTGAGE CORP | TEN | TENNECO AUTOMOTIVE INC |
| FRK | FLORIDA ROCK INDS INC | TER | TERADYNE IN |
| FRX | FOREST LABS INC | TEX | TEREX CORP NEW |
| FSH | FISHER SCIENTIFIC INTL INC | TFS | THREE FIVE SYSTEMS INC |
| FSS | FEDERAL SIGNAL CORP | TFX | TELEFLEX INC |
| FST | FOREST OIL CORP | TG | TREDEGAR CORP |
| FTN | FIRST TENNESSEE NATIONAL CORP | TGI | TRIUMPH GROUP INC NEW |
| FTO | FRONTIER OIL CORP | TGT | TARGET CORP |
| G | GILLETTE CO | TGX | THERAGENICS CORP |

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| GAP | GREAT ATLANTIC & PAC TEA INC | THC | TENET HEALTHCARE CORP |
| GAS | NICOR INC | THO | THOR INDUSTRIES INC |
| GB | WILSON GREATBATCH TECH | THX | HOUSTON EXPLORATION CO |
| GBX | GREENBRIER COMPANIES INC | TIF | TIFFANY & CO NEW |
| GCI | GANNETT INC | TII | THOMAS INDUSTRIES INC |
| GCO | GENESCO INC | TIN | TEMPLE INLAND INC |
| GD | GENERAL DYNAMICS CORP | TJX | T J X COMPANIES INC NEW |
| GDI | GARDNER DENVER CO | TKR | TIMKEN COMPANY |
| GDT | GUIDANT CORP | TLB | TALBOTS INC |
| GDW | GOLDEN WEST FINANCIAL CORP | TMK | TORCHMARK CORP |
| GE | GENERAL ELECTRIC CO | TMO | THERMO ELECTRON CORP |
| GES | GUESS INC | TNB | THOMAS & BETTS CORP |
| GET | GAYLORD ENTERTAINMENT CO NEW | TNC | TENNANT CO |
| GFF | GRIFFON CORP | TNL | TECHNITROL INC |
| GFR | GREAT AMERICAN FINANCIAL RES INC | TOD | TODD SHIPYARDS CORP |
| GGC | GEORGIA GULF CORP | TOL | TOLL BROTHERS INC |
| GGG | GRACO INC | TOO | TOO INC |
| GIS | GENERAL MILLS INC | TOY | TOYS R US INC |
| GLK | GREAT LAKES CHEM CORP | TR | TOOTSIE ROLL INDS INC |
| GLT | GLATFELTER P H CO | TRB | TRIBUNE COMPANY NEW |
| GM | GENERAL MOTORS CORP | TRC | TEJON RANCH CO |
| GMP | GREEN MOUNTAIN PWR CORP | TRH | TRANSATLANTIC HOLDINGS INC |
| GMT | G A T X CORP | TRI | TRIAD HOSPITALS INC |
| GP | GEORGIA PACIFIC CORP | TRK | SPEEDWAY MOTORSPORTS INC |
| GPC | GENUINE PARTS CO | TRN | TRINITY INDUSTRIES INC |
| GPI | GROUP 1 AUTOMOTIVE INC | TRR | T R C COMPANIES INC |
| GPS | GAP INC | TSS | TOTAL SYSTEM SERVICES INC |
| GPT | GREENPOINT FINANCIAL CORP | TT | TRANSTECHNOLOGY CORP |
| GPX | G P STRATEGIES CORP | TTC | TORO COMPANY |
| GR | GOODRICH CORP | TTI | TETRA TECHNOLOGIES INC |
| GRP | GRANT PRIDECO INC | TTN | TITAN CORP |
| GS | GOLDMAN SACHS GROUP INC | TUG | MARITRANS INC |
| GSE | GUNDLE S L T ENVIRONMENTAL INC | TUP | TUPPERWARE CORP |
| GT | GOODYEAR TIRE & RUBR CO | TW | 21ST CENTURY INSURANCE GROUP |
| GTI | GRAFTECH INTERNATIONAL LTD | TWP | TREX INC |
| GTK | GTECH HOLDINGS CORP | TWR | TOWER AUTOMOTIVE INC |
| GTN | GRAY TELEVISION INC | TWX | TIMER WARNER INC |
| GTY | GETTY REALTY CORP NEW | TXI | TEXAS INDUSTRIES INC |
| GVA | GRANITE CONSTRUCTION INC | TXN | TEXAS INSTRUMENTS INC |
| GWW | GRAINGER W W INC | TXT | TEXTRON INC |
| GXP | GREAT PLAINS ENERGY INC | TXU | T X U CORP |
| GY | GENCORP INC | TYL | TYLER TECHNOLOGIES INC |
| HAE | HAEMONETICS CORP MASS | UAG | UNITED AUTO GROUP INC |
| HAL | HALLIBURTON COMPANY | UB | UNIONBANCAL CORP |
| HAR | HARMAN INTL INDS INC NEW | UBH | U S B HOLDING CO INC |
| HAS | HASBRO INC | UCI | UICI |
| HB | HILLENBRAND INDS INC | UCL | UNOCAL CORP |
| HC | HANOVER COMPRESSOR CO | UCO | UNIVERSAL COMPRESSION HLDGS INC |
| HCA | H C A INC | UFI | UNIFI INC |
| HCR | MANOR CARE INC NEW | UGI | U G I CORP |

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| HD | HOME DEPOT INC | UIC | UNITED INDUSTRIAL CORP |
| HDI | HARLEY DAVIDSON INC | UIL | U I L HOLDING CORP |
| HDL | HANDLEMAN CO | UIS | UNISYS CORP |
| HE | HAWAIIAN ELECTRIC INDUSTRIES | UNA | UNOVA INC |
| HEI | HEICO CORP NEW | UNF | UNIFIRST CORP |
| HET | HARRAHS ENTERTAINMENT INC | UNH | UNITEDHEALTH GROUP INC |
| HGR | HANGER ORTHOPEDIC GROUP INC | UNM | UNUMPROVIDENT CORP |
| HHS | HARTE HANKS INC | UNP | UNION PACIFIC CORP |
| HIG | HARTFORD FINANCIAL SVCS GROUP IN | UNS | UNISOURCE ENERGY CORP |
| HKF | HANCOCK FABRICS INC | UNT | UNIT CORP |
| HL | HECLA MINING CO | UPC | UNION PLANTERS CORP |
| HLT | HILTON HOTELS CORP | URI | UNITED RENTALS INC |
| HMN | HORACE MANN EDUCATORS CORP NEW | URS | U R S CORP NEW |
| HNI | HON INDUSTRIES INC | USB | U S BANCORP DEL |
| HNR | HARVEST NATURAL RESOURCES INC | USG | U S G CORP |
| HNZ | HEINZ H J CO | UST | U S T INC |
| HON | HONEYWELL INTERNATIONAL INC | USU | U S E C INC |
| HP | HELMERICH & PAYNE INC | UTR | UNITRIN INC |
| HPC | HERCULES INC | UTX | UNITED TECHNOLOGIES CORP |
| HPQ | HEWLETT PACKARD CO | UVV | UNIVERSAL CORPORATION |
| HRB | BLOCK H & R INC | VAL | VALSPAR CORP |
| HRH | HILB ROGAL & HAMILTON CO | VAR | VARIAN MEDICAL SYSTEMS INC |
| HRL | HORMEL FOODS CORP | VC | VISTEON CORP |
| HRS | HARRIS CORP | VCI | VALASSIS COMMUNICATIONS INC |
| HSC | HARSCO CORP | VFC | V F CORP |
| HSY | HERSHEY FOODS CORP | VGR | VECTOR GROUP LTD |
| HU | HUDSON UNITED BANCORP | VHI | VALHI INC NEW |
| HUF | HUFFY CORP | VLO | VALERO ENERGY CORP NEW |
| HUG | HUGHES SUPPLY INC | VLY | VALLEY NATIONAL BANCORP |
| HUM | HUMANA INC | VMC | VULCAN MATERIALS CO |
| HVT | HAVERTY FURNITURE COS INC | VMI | VALMONT INDUSTRIES INC |
| HZO | MARINEMAX INC | VOL | VOLT INFORMATION SCIENCES INC |
| IAL | INTERNATIONAL ALUMINUM CORP | VPI | VINTAGE PETROLEUM INC |
| IBC | INTERSTATE BAKERIES CORP | VRC | VARCO INTERNATIONAL INC DEL |
| IBM | INTERNATIONAL BUSINESS MACHS COR | VRX | VALEANT PHARMACEUTICALS INTL |
| ICN | I C N PHARMACEUTICALS INC NEW | VSH | VISHAY INTERTECHNOLOGY INC |
| IDA | IDACORP INC | VTS | VERITAS D G C INC |
| IDT | I D T CORP | VVC | VECTREN CORP |
| IES | INTEGRATED ELECTRICAL SRVCS INC | VVI | VIAD CORP |
| IEX | IDEX CORP | VZ | VERIZON COMMUNICATIONS |
| IFC | IRWIN FINANCIAL CORP | WAB | WABTEC CORP |
| IFF | INTERNATIONAL FLAVORS & FRAG INC | WAG | WALGREEN CO |
| IGT | INTERNATIONAL GAME TECHNOLOGY | WAT | WATERS CORP |
| IHI | INFORMATION HOLDINGS INC | WB | WACHOVIA CORP |
| IHP | I H O P CORP NEW | WCC | WESCO INTERNATIONAL INC |
| IHR | INTERSTATE HOTELS & RESORTS INC | WDC | WESTERN DIGITAL CORP |
| IKN | IKON OFFICE SOLUTIONS INC | WEC | WISCONSIN ENERGY CORP |
| IMC | INTERNATIONAL MULTIFOODS CORP | WEH | WESTCOAST HOSPITALITY CORP |
| IMN | IMATION CORP | WEN | WENDYS INTERNATIONAL INC |
| IMR | I M C O RECYCLING INC | WES | WESTCORP INC |

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| INT | WORLD FUEL SERVICES CORP | WFC | WELLS FARGO & CO NEW |
| IO | INPUT OUTPUT INC | WFR | M E M C ELECTRONIC MATERIALS INC |
| IOM | IOMEGA CORP | WGL | W G L HOLDINGS INC |
| ION | IONICS INC | WGO | WINNEBAGO INDUSTRIES INC |
| IP | INTERNATIONAL PAPER CO | WGR | WESTERN GAS RESOURCES INC |
| IPG | INTERPUBLIC GROUP COS INC | WHC | WACKENHUT CORRECTIONS CORP |
| IRF | INTERNATIONAL RECTIFIER CORP | WHI | W HOLDING CO INC |
| IRM | IRON MOUNTAIN INC PA | WHR | WHIRLPOOL CORP |
| ITG | INVESTMENT TECHNOLOGY GP INC NEW | WIN | WINN DIXIE STORES INC |
| ITN | INTERTAN INC | WL | WILMINGTON TRUST CORP |
| ITT | I T T INDUSTRIES INC IND | WLM | WELLMAN INC |
| ITW | ILLINOIS TOOL WORKS INC | WLP | WELLPOINT HEALTH NETWORKS INC |
| IVC | INVACARE CORP | WLS | LYON WILLIAM HOMES |
| JAH | JARDEN CORP | WLT | WALTER INDUSTRIES INC |
| JBL | JABIL CIRCUIT INC | WLV | WOLVERINE TUBE INC |
| JBX | JACK IN THE BOX INC | WM | WASHINGTON MUTUAL INC |
| JCI | JOHNSON CONTROLS INC | WMI | WASTE MANAGEMENT INC DEL |
| JCP | PENNEY J C CO INC | WMK | WEIS MARKETS INC |
| JEC | JACOBS ENGINEERING GROUP INC | WMO | WAUSAU MOSINEE PAPER CORP |
| JEF | JEFFERIES GROUP INC NEW | WMS | W M S INDUSTRIES INC |
| JH | HARLAND JOHN H CO | WMT | WAL MART STORES INC |
| JHF | HANCOCK JOHN FINANCIAL SVCS INC | WNC | WABASH NATIONAL CORP |
| JLG | J L G INDUSTRIES INC | WON | WESTWOOD ONE INC |
| JLL | JONES LANG LASALLE INC | WOR | WORTHINGTON INDUSTRIES INC |
| JNJ | JOHNSON & JOHNSON | WPC | W P CAREY & CO LLC |
| JNS | JANUS CAP GROUP INC | WPI | WATSON PHARMACEUTICALS INC |
| JNY | JONES APPAREL GROUP INC | WPS | W P S RESOURCES CORP HOLDING CO |
| JOE | ST JOE CO | WR | WESTAR ENERGY INC |
| JP | JEFFERSON PILOT CORP | WRC | WESTPORT RESOURCES CORP NEW |
| JPM | J P MORGAN CHASE & CO | WSM | WILLIAMS SONOMA INC |
| JRC | JOURNAL REGISTER CO | WST | WEST PHARMACEUTICAL SERVICES INC |
| JWL | WHITEHALL JEWELLERS INC | WWW | WOLVERINE WORLD WIDE INC |
| JWN | NORDSTROM INC | WWY | WRIGLEY WILLIAM JR CO |
| K | KELLOGG CO | WY | WEYERHAEUSER CO |
| KBH | K B HOME | WYE | WYETH |
| KDE | 4 KIDS ENTERTAINMENT INC | X | UNITED STATES STEEL CORP NEW |
| KDN | KAYDON CORP | XEL | X C E L ENERGY INC |
| KEG | KEY ENERGY SERVICES INC | XOM | EXXON MOBIL CORP |
| KEI | KEITHLEY INSTRUMENTS INC | XRX | XEROX CORP |
| KEM | KEMET CORP | XTO | X T O ENERGY INC |
| KEX | KIRBY CORP | Y | ALLEGHANY CORP DE |
| KEY | KEYCORP NEW | YCC | YANKEE CANDLE INC |
| KFY | KORN FERRY INTERNATIONAL | YRK | YORK INTL CORP NEW |
| KG | KING PHARMACEUTICALS INC | YUM | YUM BRANDS INC |
| KKD | KRISPY KREME DOUGHNUTS INC | Z | FOOT LOCKER INC |
| KMB | KIMBERLY CLARK CORP | ZAP | ZAPATA CORP |
| KMG | KERR MCGEE CORP | ZLC | ZALE CORP NEW |
| KMI | KINDER MORGAN INC KANSAS | ZNT | ZENITH NATIONAL INSURANCE CORP |
| KMT | KENNAMETAL INC | ZQK | QUIKSILVER INC |
| KO | COCA COLA CO | AES | A E S CORP |

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| KR | KROGER COMPANY | ATH | ANTHEM INC |
| KRB | M B N A CORP | AWE | A T & T WIRELESS SVCS INC |
| KRI | KNIGHT RIDDER INC | AWK | AMERICAN WATER WORKS INC |
| KSE | KEYSPAN CORP | BNK | BANKNORTH GROUP INC |
| KSS | KOHL'S CORP | CE | CONCORD E F S INC |
| KSU | KANSAS CITY SOUTHERN INDS INC | CIT | C I T GROUP INC NEW |
| KTO | K 2 INC | COL | ROCKWELL COLLINS INC |
| KWD | KELLWOOD COMPANY | CPN | CALPINE CORP |
| KWK | QUICKSILVER RESOURCES INC | GLW | CORNING INC |
| KWR | QUAKER CHEMICAL CORP | KFT | KRAFT FOODS INC |
| LAB | LABRANCHE & CO INC | L | LIBERTY MEDIA CORP NEW |
| LAD | LITHIA MOTORS INC | LU | LUCENT TECHNOLOGIES INC |
| LAF | LAFARGE CORP | OEI | OCEAN ENERGY INC NEW |
| LBY | LIBBEY INC | PCS | SPRINT CORP |
| LC | LIBERTY CORP SC | PFG | PRINCIPAL FINANCIAL GROUP INC |
| LDG | LONGS DRUG STORES INC | PRU | PRUDENTIAL FINANCIAL INC |
| LDL | LYDALL INC | Q | QWEST COMMUNICATIONS INTL INC |
| LDR | LANDAUER INC | RRI | RELIANT RESOURCES INC |
| LEA | LEAR CORP | SLR | SOLETRON CORP |
| LEE | LEE ENTERPRISES INC | WMB | WILLIAMS COS |
| LEG | LEGGETT & PLATT INC | WTW | WEIGHT WATCHERS INTL INC NEW |
| LEH | LEHMAN BROTHERS HOLDINGS INC | ZMH | ZIMMER HOLDINGS INC |

Appendix V

NYSE Specialist Firms

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| N0003 | WAGNER STOTT BEAR SPEC. |
| N0034 | LA BRANCHE CO. |
| N0041 | FLEET MEEHAN SPECIALIST |
| N0050 | SUSQUEHANNA SPECIALISTS |
| N0055 | SPEAR LEEDS AND KELLOGG |
| N0061 | VAN DER MOOLEN SPECIALISTS USA |
| N0070 | PERFORMANCE SPECIALIST GROUP LLC |

NASD Market Centers

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| SCHB | SCHB(US) SCHWAB CAPITAL MARKETS L.P. |
| TACT | TACT(US) AUTOMATED CONFIRMATION TRANSACTION SERVICE |
| TARCA | ARCA(US) ARCHIPELAGO SECURITIES L.L.C. |
| TAUTO | *AUTO(US) AUTOMATED TRADING DESK FINANCIAL SERVICES, LLC |
| TBBNT | BBNT (US) SCOTT AND STRINGFELLOW INC. |
| TBRGE | BRGE (US) NEWBRIDGE SECURITIES CORPORATION |
| TBRUT | BRUT(US) BRUT, LLC |
| TCAES | CAES(US) COMPUTER ASSISTED EXECUTED SYSTEM |
| TDIRA | DIRA (US) DIRECT ACCESS BROKERAGE SERVICES |
| TFAHN | FAHN (US) OPPENHEIMER & CO. INC. |
| TFPKI | FPKI (US) FOX-PITT KELTON INC. |
| TFRGP | FRGP (US) FORGE FINANCIAL GROUP, INC. |
| TINET | INET(US) INET ATS, INC. |
| TJBOC | JBOC (US) NATIONAL CLEARING CORP. |
| TLYON | CREDIT LYONNAIS SECURITIES |
| TMADF | MADF(US) BERNARD L. MADOFF |
| TMAYF | MAYF(US) MAY FINANCIAL CORP |
| TMCBT | MCBT(US) MOORS AND CABOT INC. |
| TMONT | MONT(US) BANC OF AMERICA SECURITIES LLC |
| TNYFX | NYFX(US) NYFIX MILLENUM, L.L.C. |
| TSBSH | *SBSH (US) CITIGROUP GLOBAL MARKETS INC. |
| TSOAR | STERLING FINANCIAL INVESTMENT GROUP |
| TSSBS | SSBS(US) STATE STREET GLOBAL MARKETS, LLC |
| TSWST | SWST(US) SOUTHWEST SECURITIES, INC. |
| TTDCM | TDCM(US) TD WATERHOUSE CAPITAL MARKETS, INC. |
| TTHRD | THRD(US) THE THIRD MARKET CORP. |
| TTRIM | TRIM(US) KNIGHT CAPITAL MARKETS, INC. |
| TUBSW | UBS SECURITIES LLC |
| TVFIN | VFIN (US) VFINANCE INVESTMENTS INC. |
| TWRHC | WRHC (US) WILLIAM R. HOUGH & CO. |
| WATHWATH | WATH(US) TD WATERHOUSE INVESTOR SERVICES, INC. |

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| PARCAX | PACIFIC EQUITIES ARCHIPELAGO EXCHANGE |
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