# OFFICE OF ECONOMIC ANALYSIS
# MEMORANDUM

**To:** Chairman Christopher Cox

**Through:** James Overdahl

**From:** Daniel Aromi and Cecilia Caglio

**Date:** December 17, 2008

**Re:** Analysis of a short sale price test using intraday quote and trade data.

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You have asked us to summarize the previous work of our office concerning the uptick rule and variants of it for purposes of responding to Congressional inquiries on these subjects. This memo reports a series of analyses aimed at understanding how restrictive a short sale price test rule structured in a similar manner to that described in the attached document produced for discussion purposes (see specifically the section on "Liquidity Add Plus Penny Uptick") would be. For this purpose, we used consolidated intraday quote and trade data corresponding to six trading days during the month of September 2008. During this high volatility period, we examined how the short selling restrictions from a "liquidity add plus uptick" rule vary for stocks with different characteristics, for different price increments in the rule ("bid increments"), and for different market conditions.

We conducted three analyses, each designed to gauge different aspects of the potential restriction. First, we examined whether the short sales executed during this period were executed at prices allowed by the rule. Next, we examined how often the rule would force short sellers to wait behind an order book because their short sales cannot be priced below the best ask price. Finally, we simulated the submission of short sales to study how such a rule would affect execution rates and times to execution of short sale orders.

Our findings from each of these analyses indicate that the restrictions imposed by a "liquidity add plus uptick" rule depend on the number of bid increments, market conditions and stock characteristics. A short sale price test would be more restrictive for lower priced stocks and more active stocks. Counter to the intent of such a rule, we also found that a short sale price test would be most restrictive during periods with little volatility. The rule would be less restrictive on short sale orders during periods of large positive returns and large negative returns, though the restrictions are greater in rapidly declining markets compared to rapidly advancing markets.

Finally, our analyses showed that even moderate changes in bid increments can have a big impact on the constraints imposed on short selling activity. Short selling activity was deeply constrained in actively traded stocks even for low values of the bid increment (such as one to three cents) because these stocks were characterized by narrow bid ask spreads. For example, we found that for lower-priced stocks in the actively traded category, a bid increment of three

cents would restrict short sales to prices above the best ask 99% of the time. This means that short sellers would need to place orders at prices above the ask resulting in lower execution rates and longer time to execution. For the same group of stocks, for periods of moderate volatility, a three cent bid increment level results in less than 20% of our simulated orders being executed. With a one-cent bid increment, the execution rate would be approximately 60%. These statistics suggest that, for practical purposes, high bid increments, such as five or ten cents, might be equivalent to a ban on short selling in some stocks, especially during periods when prices are not changing rapidly.

## ANALYSIS

### Proposed Tests

A short sale price test would limit the prices at which short sales could be submitted. For a given stock, the impact of such a rule is a function of market characteristics such as bid ask spreads, arrival rate of incoming orders and volatility in the price of the stock.

For stocks with narrow bid ask spreads, or for short selling rules requiring multiple price increments, a short sale price test might require short sale orders to be placed only at prices that are higher than the best ask. This means that the order will be standing in line behind better priced sell orders. Trading centers have established policies that are designed to prevent an order from executing before any standing order with higher price priority or any standing order with equal price but higher time priority. In periods of low volatility or low arrival rate of incoming orders the execution rate of sell orders submitted at prices that are higher than the best ask can be very low.

Reg NMS established that orders placed at the best ask and best bid in each exchange are protected orders. This means that SROs implement procedures that prevent the execution of trades at a price that is inferior to the best bid or offer displayed by another market center at the time of execution. This means that a short sale order cannot be executed before any better priced sell orders displayed at the best ask of any exchange. These observations call attention to the ways in which a short sale price test restricts the submission and the execution rate of short sale orders.

The objective of this memo is to assess restrictions that would be imposed by a short sale price test rule. We use historical data to determine the impact of such a rule.

A short sale price test rule would effectively create a “minimum shortable price” (MSP) below which no short sale orders can be priced. The MSP from a “liquidity add plus uptick” rule would satisfy the following two restrictions:

(1) *Greater Than Best Bid* – at least *n* cents above the national best bid.

(2) *Greater Than Last Different Tick* –at least *1* cent above the last trade reported to the consolidated tape, or the last sale price if it was higher than the last different price (*i.e.*, a zero-plus tick).

In our analyses, (described in further detail below), we build a hypothetical MSP from past order book data. This price is a function of the quoting and trading activity as well as the price increment of the short sale price test. We also calculate a "best ask price" using data from consolidated quotes.

We propose three tests that would analyze the impact of a short sale price test. The first test, estimates the fraction of short sale trades that would occur with a price below the MSP (*MSP vs. price of short sales*). A low proportion of trades occurring at prices below the MSP threshold would be an indication that the short sale price test is not significantly restrictive. In other words, the rule would be unlikely to delay the execution of short sales if most of the short sales are already executed at high enough prices.

The second test computes the fraction of the day in which the MSP was above, equal to or below the "best ask price" (*MSP vs. Best Ask*). According to the short sale price test, if the MSP was above the "best ask price" no order can be placed at or below the best ask.

As stated above, under the existing market rules and Reg NMS regulations, the ability to submit orders at or below the best ask has a first order impact on order execution. Not being able to place orders at the best ask, could result in an important restriction on short selling activity, since sell orders placed above the best ask may take more time to execute or might not be executed at all.

The last test simulates the submission of short sale orders and computes the probability that an order would execute and the time to execution. Different bid increment levels were considered. The types of orders considered were limited, but the analysis still improves our understanding of the constraints imposed by a short sale price test.

Our analysis was based on historical trade and quote data. We acknowledge that if a short sale price test had been in place, the shape of the order book and the sequence of trades may be different than what we currently observe using historical trade and quote data. Nevertheless, we believe that our analysis was a good benchmark that can be used to assess the impact of a short sale price test.

**Methods and Data**

We used intraday quote and trade data from TAQ for six trading days during September 2008 (09/11/2008 through 09/18/2008). These days were characterized by high volatility; so, as a result, our analysis sheds light on the constraints imposed by a short sale price test in a high volatility environment.[1]

[1] We acknowledge that under different market conditions the statistics might change. For the period of the analysis volume was higher than average and spreads were larger than average. We think that this implies that, for example, executions rates were expected to be higher for our sample period compared to less volatile periods.

We calculated the “best ask price” and “best bid price” using data for Nasdaq, NYSE, NYSE Arca and ADF.[2] We used this information, together with last trade information, to generate an MSP. If the latest tick was an uptick, then the

- MSP was equal to the maximum of "best bid price + n cents", where “n” is the short sale price test increment from 1 to 5 cents, and "Last Trade Price".

If the latest tick was a downtick, then the

- MSP was equal to the maximum of "best bid price + n cents", where “n” is the short sale price test increment from 1 to 5 cents, and "Last Trade Price + 1 cent".

For our analysis we focused only on ordinary common stocks as classified by CRSP. We examined only NYSE, Amex and Nasdaq listed stocks and we excluded OTCBB or pink sheets stocks. We also eliminated any stock whose average quoted price on the day of the analysis was below $1.

To show how the price test affected different stocks, we grouped stocks by liquidity and price levels. We first classified stocks by the average number of shares traded in the month of July 2008. We used that variable to form five subgroups. Since the distribution of share volume of stocks is highly skewed, we chose to form smaller groups for highly traded stocks. Each of these subgroups were, in turn, divided into terciles according to the average price level on the trading day for a total of 15 different categories. The average price level equals the time weighted average of the midquote as calculated from the best ask and best bid.

The 6 day period ranging from September 11$^{th}$ to September 18$^{th}$ 2008 was characterized by large up and down market movements. In order to better understand how the short sale price test would affect the execution of short sales, we ran the analysis by looking at impact of such a rule under different market conditions. The impact of the rule is likely to depend on the market conditions that are associated with changes in bid ask spreads, volatility and the patience of market participants.[3]

We computed stock returns $r_i$ for five minute intervals for each stock and we classify them into the following five categories:

1. $r_i < -100\ bp$
2. $-100\ bp < r_i < 0$
3. $r_i = 0$

[2]We have not included all market centers because we found instances in which stale or out of sequence quotes resulted in erroneous statistics. By considering a subset of market centers, we lowered the possibility that stale quotes might have resulted in incorrect calculation of midquotes and spreads. At the same time, we believe that the subset of markets considered is substantial and the analysis is not significantly affected by the exclusion of some market centers.

[3] The differentiated impact of the rule may have important policy implications. For example, in the analysis of the results of the Reg SHO pilot, one important hypothesis that proved to be unfounded is that an uptick test would dampen downward returns.

4. $0 < r_i < 100\ bp$
5. $r_i > 100\ bp$

where *bp* is basis points.

This classification will be used to report the results of our different measures of the level of restriction imposed by a short sale price test.

**Results on Historical Data**

*a- MSP vs. price of short sales*

In this subsection, we analyzed the fraction of short sale trades that would occur with a price below the MSP. A low proportion of trades occurring at prices below the MSP threshold would be an indication that the short sale price test would not be significantly restrictive. In other words, the rule would be unlikely to delay the execution of short sales if most of the short sales are executed at high enough prices already.

The computed statistics are shown on Table 1. Our findings indicate that the short sale price test would be more restrictive for highly liquid stocks and for lower-priced stocks. According to the computed statistics, for actively traded stocks, the fraction of short sales with price below MSP ranged between 99% (for 5 cent increment) and 61% (for 1 cent increment).

For less active stocks, the short sale price test rule would generally be less restrictive. Based on our analysis, the fraction of short sales with prices below MSP ranged between 59% (for 1 cent increment) and 83% (for 5 cents increment). When we considered the size of the increment relative to the size of the spread, the analysis suggested that the short sell price test was more restrictive for lower spread stocks. Moreover, short selling in low price stocks was prohibited more often than in high price stocks.

The data showed that a one cent increment would be restrictive for more than 60% of the short sales submitted. We also noticed that a five cents increment would be close to an outright ban on short selling for highly- and moderately-active stocks. In particular, for low-priced active stocks between 68% (one cent increment) to 99%(five cent increment) of short sales had a price below the MSP and thus, would not have executed at the same price.

In order to analyze the impact of the rule in down markets as opposed to up markets, we computed the fraction of short sale trades that occurred at prices below the MSP, based on contemporaneous five minute return categories. These results are presented in Table 2. To understand whether momentum type strategies were restricted more than contrarian strategies, we present the same data classified by the return in the previous five minute period. These results are presented in Table 3.

Table 2 indicates that the short sale price test would be more restrictive during extreme negative market returns than during extreme positive market returns. This was true across all groups of

stocks as the fraction of short sales with prices below MSP ranged between 76% and 69%. For the case of one cent bid increment in the group of the most liquid stocks with the lowest prices, the fraction of trades at prices below MSP is approximately 75% for periods of negative returns and between 63% and 56% for periods of positive returns. Short selling was less restricted for upward markets as the fraction of short sales with price below MSP ranged between 39% and 56%. We also noticed that for larger price increments, the differences in the percentage of restricted short sales did not appear to be monotonic. This is also true for one cent increments in many of the more active groups. The results seem more monotonic for the less active stocks than for the active stocks.

When comparing different groups of stocks, we found that a short sale price test would be more restrictive for highly traded stocks and for the group of stocks with low prices. When analyzing the difference in the fraction of restricted short sales between the extreme positive and extreme negative market movements we noticed a larger difference as we move from high to medium and low traded stocks.

The analysis for the five minutes lagged returns in Table 3 showed a reduced asymmetry of high versus low returns. The result suggests that the price test does not restrict momentum traders more than contrarian traders.[4]

Increasing bid increments results in significant variation in our measure. For highly traded stocks, under bid increment of 3 cents, around 90% of the short sales occurred at a price that was below the computed MSP and thus, the majority of short sales could not be executed by an incoming sell order.

In discussing the results we should again keep in mind that had the short sale price test actually been in place, the short seller submission strategies would most likely have been different.

*b- MSP vs. Best Ask*

In this part of the analysis, we examined the relationship of the MSP and the best ask spread. The purpose of this analysis was to understand whether the short sellers can place an order in the limit order book that is likely to be executed or can set a lower ask price. While the previous section focused on the price of executed short sales, here the focus is on the restrictions on order submission. The restriction will result from an interaction between already established Reg NMS rules on order protection and the hypothetical short sale price tests. The comparison between MSP and best ask price results in similar general conclusions to the analysis above. Our findings, in Table 4, indicate that the short sale price test would be more restrictive for more active stocks and for lower-priced stocks. For example, for highly traded stocks with a low price, the MSP was lower or equal to the best ask price with 1 cent increment 39% of the time while for the subgroup of stocks with low level of volume and low price level that number equaled 63%.

[4] Momentum traders purchase when the market rises and sell when the market falls in the previous trading session. Contrarian investors buy after a drop in the market and sell after a rise.

We also found that changes in the price test increment in the MSP formula would have a significant impact on how restrictive the short sale price would be. For example, for highly traded stocks with low prices, increasing the bid increment from 1 cent to 2 cents reduced the time that the MSP was lower or equal to the "best ask price" from 39% to 5% of the time. For the same group, a bid increment of 3 cents resulted in the MSP being lower or equal to the "best ask price" only 1% of the time.

We repeated the analysis on the relation between the MSP and the best ask spread above by looking at the five minute contemporaneous and lagged return. These second set of statistics are reported in Tables 5 and 6.

When we compared the MSP vs. Best Ask Price for different return levels, we observed an almost symmetric effect for the restriction on highly traded stocks. For this group, more volatile periods were associated with a lower level of restriction.

For stocks with medium and low levels of trading activity the results indicated that the rule would be more restrictive for negative market returns. Overall, the analysis showed that the rule would be more restrictive for highly liquid stocks. The results were confirmed for the five minutes lagged returns.

The analysis confirms that changes in the price test increment in the MSP formula would have a significant impact on how restrictive the short sale price test would be.

**Simulation Results**

In this section, the impact of a short sale price test was appraised by simulating the submission of short sale orders. In the previous analysis, we provided indirect calculations of the impact of the rule. We showed how the rule would constrain the ability to submit short sale orders. With the simulations, we computed the direct impact of the rule on short sale orders. We compute how the constraints imposed on order submission would have an effect on the probability of executing a short sale.

We simulated independent submission of small short sale orders to NYSE Arca. By independent, we mean that each order submitted was an unrelated event. We selected a small order size because it allowed for a more precise estimation of execution rates and time to execution. We have not considered sequence-connected orders because this would require modeling the dynamics of an order book. That is, we would have had to make assumptions about how the submission of one order would impact the ability to submit and execution rates of subsequent orders. Again, the assumptions made would have compromised the precision of the estimates.

Any interpretation of the results should take into account the fact that we simulated the type of order that exhibits the highest execution rate. Larger orders or a sequence of small orders would

be more negatively affected by a short sale price test, and thus, we would observe lower execution rates. Having this in mind, the statistics below should be viewed as a lower bound on the potential impact of the rule.

*a. Outline of the algorithm:*

For each stock we ran as many independent simulations as minutes during the trading day. At the beginning of each 60 second period, a new simulation was started. The input quote and trade data was the original information, unaffected by any simulation computed for a previous period. The order size was 100 shares.[5]

In our exercise, the order was priced at submission to satisfy the liquidity add plus uptick restriction described above for increments of one to three cents. TAQ data on quotes and trades was also used to calculate the initial price of the order and if, or when, the order was executed.

i- Order submission:

At the beginning of each one-minute period, the first step of the algorithm is to observe whether an order can be submitted at the best ask or better.[6]

An order was submitted at MSP (minimum shortable price) if that price was equal to or below the "best ask" at ARCA. If this was not the case, then the order was submitted at the MSP once MSP was equal or below the "best ask" at ARCA. No order was submitted if the MSP was always higher that the "best ask" at ARCA. In our statistics, this case counts as a period in which there was no trade execution.

We do not consider the submission of an order at a price that was higher than the "best ask". We were not able to observe depth levels at prices that were worse than the "best ask" which limits our ability to calculate when the order would be executed. This choice reduced the calculated rates of execution in our exercise.

ii- Order execution:

Once a simulated order was submitted, it was executed at the moment in which any of the following conditions were met:

- ARCA's "**best bid**" was **higher** than or equal to the price of the order.
- TAQ's trade file reported a **trade at a price higher** than the order's price.
- If the order was submitted below ARCA's "**best ask**" and TAQ's trade file reports, when a trade at ARCA at a price higher or equal to the order's price.

[5] This is smaller than the average size of a short sale for the period under analysis, which was approximately 250 shares. In addition, many times, traders split the original order into smaller orders send to different exchanges or at different times to improve price execution. This means that the average size of the original short sale order, was higher than the average size of the short sales as reported by the exchanges.

[6] We place a hypothetical order every minute, independently of the time of the day and stock characteristics.

- If the order was submitted at the **"best ask**" and ARCA's **"best ask"** did not change since the order was submitted, when "cumulative volume of trades reported by ARCA at the best ask since the order was submitted" was higher than the "size of ARCA's best ask at the moment of the order submission +100".
- If the order was submitted at the "best ask" and ARCA's "best ask" had increased since the order was submitted, when a trade reported by ARCA has a price equal or higher than the order's price.

iii- Order cancellation:

If a simulated order was not executed at the end of the one minute period, the order was canceled.

The simulations we computed cannot be easily compared to other studies that use historic order submission and execution. (See for example, Alexander, Gordon and Mark Peterson, "Implications of a Reduction in Tick Size on Short-Sell Order Execution", *Journal of Financial Intermediation* 11, 37-60 (2002) or Alexander, Gordon and Mark Peterson, "Short Selling in the New York Stock Exchange and the Effects of the Uptick Rule", *Journal of Financial Intermediation* 8, 90-116(1999).) In our exercise orders were submitted at a constant rate and only when the MSP allowed for submission at the best ask or better. In real markets, the submission of short sale orders occurs at different rates depending of market conditions. In addition orders might be canceled at high frequencies as changes in the order book dictate changes in the limit orders. In our exercise, orders were canceled only when the 60 second period had closed.

Another reason why a comparison with the above mentioned work by Alexander and Peterson is difficult is that the markets have greatly changed since the period analyzed by those studies. Among other characteristics, these changes include fragmentation, significantly thinner bid-ask spreads and higher speed of execution, submission and cancellation of orders.

*b. Results*

The simulations showed that bid increments, stock characteristics and market conditions had a significant influence on the execution statistics. Higher bid increments reduced the rate of execution and increased the time to execution in a very significant way. Execution statistics were notably more affected for lower priced stocks. Periods of high volatility (five minute periods with positive returns above 1% or negative returns below -1%) showed higher execution rates. Finally, for a given absolute level of returns, execution rates were higher for periods of positive returns than for periods of negative returns.

Table 7 shows summary statistics on this simulation for a sample of 18 stocks. The sample consisted of 9 stocks of the highly traded group, as classified in the previous section and 9 stocks of the group with medium trading activity. For each of these groups, 3 stocks belonged to each of the price categories as detailed in the previous section (high, medium and low price).

The table presents simulations of short sale order submission under the rule for 1, 2 and 3 cents increments. In addition to that, we report statistics for a simulation in which the only restriction is that at the time of submission, the order cannot interact with displayed liquidity. The order was submitted at a price equal to "Best Bid +1 cent" and these simulations are reported under the label "Liquidity Provider."

The first two columns of the table contain information describing the subgroup of stocks to which the data corresponds. The number of simulations for each return level is reported in the fourth column.

For the simulation group, execution rates and time to execution were reported. The time to execution column calculates, for executed orders, the difference between the time in seconds at which the order was executed and the start of the one minute period of each simulation. Note that since we assume that orders were submitted only once and the MSP was equal or below the best ask, this is not time to execution since the order was submitted but rather time to execution since the simulation period started.

Not surprisingly, active stocks were associated with higher execution rates and lower time to execution. The table shows that this holds for all market conditions and price level of stocks.

Bid increments had a significant impact on the statistics. For example, for a "3 cents bid increment" during periods with moderate volatility (between -1% and 1% five minute return) execution rates were remarkably low. For highly traded low price stocks, execution rates for moderate volatility periods are below 20%. For those 20% executed orders, the average time to execution was approximately 28 seconds. This indicates not only that few orders were executed but also that the average time to execution of the simulated orders was significantly increased with an increase in the number of bid increments.

We observed that execution rates were higher for stocks with a high price. For one cent increments, execution rates were near 90% for stocks with high prices. For low price stocks, that number was below 70% if we excluded periods with high return levels (higher than 1% five minute return). This difference was more noticeable for higher bid increments. For three bid increments and with moderate volatility (between -1% and 1% five minute return) the execution rates were approximately 20% for lower priced stocks and 60% for higher priced stocks.

The analysis of periods characterized by different return levels showed that market conditions had a visible influence on execution statistics. Periods of low volatility (five minute periods with positive returns below 1% or negative returns above -1%) showed lower execution rates and lower time to execution. This difference was more evident for lower priced stocks and higher bid increments.

While volatility resulted in higher execution rates, we observed that the effect was not symmetric. For a given level in absolute returns, five minute periods with positive returns exhibited execution rates that were higher than in periods of negative returns. For example, with a bid increment of 3 cents and for highly traded lower priced stocks, a period of returns below -1% had 33% execution rates while for five minute periods with returns above 1% the execution

rates were 56%. This asymmetry holds for all groups of stocks but was more evident for lower priced stocks.

We also run simulations for a subset of stocks corresponding to leading financial institutions. This selection was made with the objective of analyzing the restriction imposed by a short sale price test on stocks of great relevance during the period of the study. The statistics for these stocks were consistent with what we have detailed above for the sample of 18 stocks.

## Appendix

### Table 1 - Minimum Shortable Price(MSP) vs. Actual Short Sale Price (9/11/2008-9/18/2008)

This table summarizes the percentage of short sales with price below the Minimum Shortable Price (MSP) for different price increments for the dates between September 11th and September 18th 2008.. If the latest tick was an uptick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price". If the latest tick was a downtick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price + 1cent". We focused only on ordinary common stocks and we excluded stocks whose price on the day of the analysis was below $1. We grouped stocks by liquidity and price levels. We first classified stocks in five groups by the average number of shares traded in the month of July 2008. Each of these subgroups were then divided into terciles according to the average price level on the trading day. The average price level equaled the time weighted average of the midquote. Best Bid and Offer calculated from Daily TAQ data corresponding to ADF, NASDAQ, NYSE and NYSE Arca. Share Volume Information corresponded to daily averages for July 2008.

| Share Volume Group | Price Group | # Obs | % of Short Sales w/price below MSP (for different increment levels) | | | | | Average Bid Ask Spread | Average Price |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 cent | 2 cents | 3 cents | 4 cents | 5 cents | | |
| High | low | 65 | 68% | 93% | 98% | 99% | 99% | 1.02 | 9.37 |
| (>7m) | med | 67 | 70% | 87% | 94% | 96% | 98% | 1.17 | 23.05 |
| | high | 67 | 61% | 76% | 83% | 89% | 91% | 2.37 | 62.3 |
| Medium High | low | 133 | 67% | 89% | 95% | 97% | 98% | 1.4 | 10.33 |
| (2.3m-7m) | med | 133 | 65% | 80% | 88% | 92% | 95% | 2.25 | 28.58 |
| | high | 134 | 59% | 70% | 77% | 83% | 87% | 4.57 | 64.85 |
| Medium | low | 266 | 64% | 83% | 91% | 95% | 97% | 1.89 | 8.77 |
| (.6m-2.3m) | med | 267 | 64% | 75% | 83% | 88% | 93% | 3.49 | 24.43 |
| | high | 267 | 58% | 67% | 73% | 79% | 83% | 6.49 | 53.14 |
| Medium Low | low | 333 | 60% | 80% | 89% | 93% | 95% | 2.32 | 4.95 |
| (180k-632k) | med | 333 | 63% | 73% | 81% | 87% | 92% | 3.83 | 14.87 |
| | high | 334 | 60% | 67% | 73% | 78% | 83% | 7.53 | 39.77 |
| Low | low | 800 | 62% | 70% | 75% | 80% | 83% | 11.12 | 2.55 |
| (363-180k) | med | 800 | 61% | 66% | 71% | 75% | 78% | 21.31 | 7.74 |
| | high | 800 | 59% | 63% | 65% | 67% | 70% | 50.07 | 31.53 |

## Table 2 - Minimum Shortable Price(MSP) vs. Actual Short Sale Price (9/11/2008-9/18/2008) contemporaneous returns

This table summarizes the percentage of short sales with price below the Minimum Shortable Price (MSP) for different price increments and for different levels of contemporaneous returns, for the dates between September 11th and September 18th 2008. If the latest tick was an uptick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price". If the latest tick was a downtick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price + 1cent". We compute stock returns ri on a five minute intervals for each stocks and we classify them into the following five categories: 1) ri < -100 bp; 2) -100 bp < ri <0; ri =0; 0< ri <100 bp; ri>100 bp. We focus only on ordinary common stocks and we exclude stocks whose price on the day of the analysis was below $1. We grouped stocks by liquidity and price levels. We first classified stocks in five groups by the average number of shares traded in the month of July 2008. Each of these subgroups were then divided into terciles according to the average price level on the trading day. The average price level equaled the time weighted average of the midquote. Best Bid and Offer calculated from Daily TAQ data corresponding to ADF, NASDAQ, NYSE and NYSE Arca. Share Volume Information corresponded to daily averages for July 2008.

| Share Volume Group | Price Group | Return (basis points) | # Obs. | Average Bid Ask Spread | % of Short Sales w/price below MSP (for different increment levels) | | |
|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | | **1 cent** | **2 cents** | **3 cents** |
| High (>7m) | low | $r_i$ < -100 bp | 2419 | 1.1 | 74% | 93% | 97% |
| | | -100 bp < $r_i$ | 10544 | 0.98 | 75% | 96% | 99% |
| | | $r_i$ =0 | 3605 | 0.99 | 65% | 98% | 100% |
| | | 0< $r_i$ <100 bp | 10218 | 1 | 63% | 94% | 99% |
| | | $r_i$>100 bp | 2620 | 1.12 | 56% | 87% | 95% |
| High (>7m) | med | $r_i$ < -100 bp | 1096 | 1.7 | 73% | 84% | 91% |
| | | -100 bp < $r_i$ | 13505 | 1.13 | 76% | 91% | 97% |
| | | $r_i$ =0 | 1709 | 1.04 | 73% | 94% | 99% |
| | | 0< $r_i$ <100 bp | 13372 | 1.16 | 69% | 88% | 96% |
| | | $r_i$>100 bp | 1284 | 1.36 | 60% | 74% | 87% |
| High (>7m) | high | $r_i$ < -100 bp | 1028 | 3.76 | 64% | 72% | 78% |
| | | -100 bp < $r_i$ | 13899 | 2.24 | 65% | 78% | 85% |
| | | $r_i$ =0 | 621 | 1.37 | 69% | 88% | 94% |
| | | 0< $r_i$ <100 bp | 13990 | 2.31 | 58% | 73% | 82% |
| | | $r_i$>100 bp | 1350 | 3.43 | 50% | 61% | 67% |
| Medium High (2.3m-7m) | low | $r_i$ < -100 bp | 2942 | 2.26 | 75% | 89% | 95% |
| | | -100 bp < $r_i$ | 22663 | 1.38 | 76% | 92% | 97% |
| | | $r_i$ =0 | 9913 | 1.05 | 67% | 98% | 99% |
| | | 0< $r_i$ <100 bp | 21916 | 1.39 | 62% | 89% | 96% |
| | | $r_i$>100 bp | 3406 | 1.96 | 51% | 79% | 90% |
| Medium High (2.3m-7m) | med | $r_i$ < -100 bp | 1769 | 4.96 | 69% | 76% | 82% |
| | | -100 bp < $r_i$ | 27525 | 2.08 | 71% | 84% | 91% |
| | | $r_i$ =0 | 1797 | 1.58 | 71% | 88% | 95% |
| | | 0< $r_i$ <100 bp | 26939 | 2.08 | 62% | 78% | 88% |
| | | $r_i$>100 bp | 2342 | 3.75 | 52% | 63% | 72% |
| Medium High (2.3m-7m) | high | $r_i$ < -100 bp | 1718 | 9.05 | 63% | 68% | 71% |
| | | -100 bp < $r_i$ | 29112 | 4.3 | 62% | 72% | 78% |
| | | $r_i$ =0 | 874 | 2.53 | 63% | 79% | 86% |
| | | 0< $r_i$ <100 bp | 28762 | 4.38 | 54% | 65% | 72% |
| | | $r_i$>100 bp | 2246 | 7.95 | 47% | 52% | 57% |
| Medium (.6m-2.3m) | low | $r_i$ < -100 bp | 5996 | 2.99 | 76% | 86% | 92% |
| | | -100 bp < $r_i$ | 44353 | 1.92 | 73% | 87% | 94% |
| | | $r_i$ =0 | 23822 | 1.2 | 66% | 96% | 99% |
| | | 0< $r_i$ <100 bp | 43056 | 1.93 | 54% | 79% | 91% |
| | | $r_i$>100 bp | 6791 | 2.99 | 46% | 69% | 82% |
| Medium (.6m-2.3m) | med | $r_i$ < -100 bp | 3308 | 7.77 | 72% | 76% | 81% |
| | | -100 bp < $r_i$ | 56220 | 3.25 | 71% | 80% | 86% |
| | | $r_i$ =0 | 4858 | 2.33 | 69% | 84% | 91% |
| | | 0< $r_i$ <100 bp | 55886 | 3.29 | 58% | 70% | 80% |
| | | $r_i$>100 bp | 4216 | 7.5 | 47% | 54% | 62% |

## Table 2 (cont'd)- Minimum Shortable Price(MSP) vs. Actual Short Sale Price (9/11/2008-9/18/2008) contemporaneous returns

This table summarizes the percentage of short sales with price below the Minimum Shortable Price (MSP) for different price increments and for different levels of contemporaneous returns, for the dates between September 11th and September 18th 2008. If the latest tick was an uptick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price". If the latest tick was a downtick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price + 1cent". We compute stock returns ri on a five minute intervals for each stocks and we classify them into the following five categories: 1) ri < -100 bp; 2) -100 bp < ri <0; ri =0; 0< ri <100 bp; ri>100 bp. We focus only on ordinary common stocks and we exclude stocks whose price on the day of the analysis was below $1. We grouped stocks by liquidity and price levels. We first classified stocks in five groups by the average number of shares traded in the month of July 2008. Each of these subgroups were then divided into terciles according to the average price level on the trading day. The average price level equaled the time weighted average of the midquote. Best Bid and Offer calculated from Daily TAQ data corresponding to ADF, NASDAQ, NYSE and NYSE Arca. Share Volume Information corresponded to daily averages for July 2008.

| Share Volume Group | Price Group | Return (basis points) | # Obs. | Average Bid Ask Spread | % of Short Sales w/price below MSP (for different increment levels) | | |
|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | | **1 cent** | **2 cents** | **3 cents** |
| Medium | high | $r_i$ < -100 bp | 2278 | 16.84 | 67% | 71% | 73% |
| (.6m-2.3m) | | -100 bp < $r_i$ | 57717 | 5.95 | 64% | 71% | 75% |
| | | $r_i$ =0 | 2306 | 4.12 | 62% | 74% | 79% |
| | | 0< $r_i$ <100 bp | 57722 | 5.92 | 52% | 60% | 66% |
| | | $r_i$>100 bp | 3059 | 14 | 43% | 48% | 51% |
| Medium | low | $r_i$ < -100 bp | 7970 | 3.84 | 76% | 86% | 91% |
| Low | | -100 bp < $r_i$ | 46141 | 2.45 | 68% | 83% | 92% |
| (180k | | $r_i$ =0 | 45645 | 1.61 | 61% | 89% | 96% |
| -632k) | | 0< $r_i$ <100 bp | 44820 | 2.4 | 48% | 74% | 89% |
| | | $r_i$>100 bp | 8108 | 3.7 | 39% | 63% | 78% |
| Medium | med | $r_i$ < -100 bp | 4278 | 8.79 | 77% | 81% | 84% |
| Low | | -100 bp < $r_i$ | 66227 | 3.66 | 71% | 78% | 85% |
| (180k | | $r_i$ =0 | 13391 | 2.55 | 66% | 79% | 88% |
| -632k) | | 0< $r_i$ <100 bp | 65788 | 3.64 | 53% | 64% | 76% |
| | | $r_i$>100 bp | 5147 | 7.85 | 41% | 48% | 57% |
| Medium | high | $r_i$ < -100 bp | 2644 | 19.49 | 73% | 75% | 77% |
| Low | | -100 bp < $r_i$ | 71499 | 7.09 | 68% | 73% | 77% |
| (180k | | $r_i$ =0 | 4548 | 5 | 61% | 71% | 77% |
| -632k) | | 0< $r_i$ <100 bp | 71607 | 7.08 | 50% | 57% | 63% |
| | | $r_i$>100 bp | 3672 | 19.21 | 40% | 44% | 48% |
| Low | low | $r_i$ < -100 bp | 15129 | 12.48 | 69% | 76% | 81% |
| (363 | | -100 bp < $r_i$ | 60360 | 8.74 | 63% | 74% | 81% |
| -180k) | | $r_i$ =0 | 102937 | 8.12 | 63% | 77% | 84% |
| | | 0< $r_i$ <100 bp | 55498 | 8.61 | 58% | 71% | 80% |
| | | $r_i$>100 bp | 13769 | 12.62 | 53% | 64% | 71% |
| Low | med | $r_i$ < -100 bp | 8934 | 29.09 | 72% | 76% | 80% |
| (363 | | -100 bp < $r_i$ | 77851 | 12.49 | 63% | 71% | 78% |
| -180k) | | $r_i$ =0 | 71691 | 16.45 | 58% | 70% | 79% |
| | | 0< $r_i$ <100 bp | 74281 | 12.16 | 52% | 62% | 73% |
| | | $r_i$>100 bp | 8887 | 37.92 | 42% | 51% | 61% |
| Low | high | $r_i$ < -100 bp | 7596 | 100.25 | 71% | 73% | 75% |
| (363 | | -100 bp < $r_i$ | 107149 | 24.56 | 64% | 67% | 71% |
| -180k) | | $r_i$ =0 | 41957 | 43.11 | 59% | 64% | 69% |
| | | 0< $r_i$ <100 bp | 108213 | 28.89 | 50% | 54% | 59% |
| | | $r_i$>100 bp | 8364 | 276.42 | 40% | 44% | 48% |

## Table 3 Minimum Shortable Price(MSP) vs. Actual Short Sale Price (9/11/2008-9/18/2008) lagged returns

This table summarizes the percentage of short sales with price below the Minimum Shortable Price (MSP) for different price increments and for different levels of lagged returns, for the dates between September 11th and September 18th 2008. If the latest tick was an uptick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price". If the latest tick was a downtick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price + 1cent". We computed stock returns ri on a five minute intervals for each stocks and we classified them into the following five categories: 1) ri < -100 bp; 2) -100 bp < ri <0; ri =0; 0< ri <100 bp; ri>100 bp. We focused only on ordinary common stocks and we excluded stocks whose price on the day of the analysis was below $1. We grouped stocks by liquidity and price levels. We first classified stocks in five groups by the average number of shares traded in the month of July 2008. Each of these subgroups were then divided into terciles according to the average price level on the trading day. The average price level equaled the time weighted average of the midquote. Best Bid and Offer calculated from Daily TAQ data corresponding to ADF, NASDAQ, NYSE and NYSE Arca. Share Volume Information corresponded to daily averages for July 2008.

| Share Volume Group | Price Group | Return (basis points) | # Obs. | Average Bid Ask Spread | % of Short Sales w/price below MSP (for different increment levels) | | |
|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | | **1 cent** | **2 cents** | **3 cents** |
| High | low | $r_i$ < -100 bp | 2419 | 0.88 | 66% | 91% | 97% |
| (>7m) | | -100 bp < $r_i$ <0 | 10544 | 0.98 | 69% | 95% | 99% |
| | | $r_i$ =0 | 3605 | 0.97 | 65% | 98% | 100% |
| | | 0< $r_i$ <100 bp | 10218 | 0.99 | 68% | 95% | 99% |
| | | $r_i$>100 bp | 2620 | 1.04 | 64% | 90% | 96% |
| High | med | $r_i$ < -100 bp | 1096 | 1.11 | 67% | 80% | 90% |
| (>7m) | | -100 bp < $r_i$ <0 | 13505 | 1.09 | 73% | 90% | 97% |
| | | $r_i$ =0 | 1709 | 0.98 | 73% | 94% | 99% |
| | | 0< $r_i$ <100 bp | 13372 | 1.13 | 72% | 89% | 96% |
| | | $r_i$>100 bp | 1284 | 1.3 | 66% | 79% | 89% |
| High | high | $r_i$ < -100 bp | 1028 | 2.88 | 57% | 67% | 73% |
| (>7m) | | -100 bp < $r_i$ <0 | 13899 | 2.17 | 62% | 76% | 84% |
| | | $r_i$ =0 | 621 | 1.32 | 68% | 88% | 94% |
| | | 0< $r_i$ <100 bp | 13990 | 2.27 | 61% | 76% | 83% |
| | | $r_i$>100 bp | 1350 | 3.43 | 56% | 65% | 71% |
| Medium | low | $r_i$ < -100 bp | 2942 | 1.61 | 64% | 85% | 93% |
| High | | -100 bp < $r_i$ <0 | 22663 | 1.28 | 69% | 91% | 97% |
| (2.3m-7m) | | $r_i$ =0 | 9913 | 1.05 | 67% | 97% | 99% |
| | | 0< $r_i$ <100 bp | 21916 | 1.3 | 68% | 91% | 97% |
| | | $r_i$>100 bp | 3406 | 1.62 | 63% | 84% | 93% |
| Medium | med | $r_i$ < -100 bp | 1769 | 3.15 | 61% | 70% | 78% |
| High | | -100 bp < $r_i$ <0 | 27525 | 1.95 | 67% | 81% | 90% |
| (2.3m-7m) | | $r_i$ =0 | 1797 | 1.56 | 70% | 87% | 95% |
| | | 0< $r_i$ <100 bp | 26939 | 1.98 | 67% | 81% | 90% |
| | | $r_i$>100 bp | 2342 | 3.04 | 61% | 70% | 78% |
| Medium | high | $r_i$ < -100 bp | 1718 | 6.64 | 54% | 60% | 64% |
| High | | -100 bp < $r_i$ <0 | 29112 | 4.07 | 59% | 69% | 75% |
| (2.3m-7m) | | $r_i$ =0 | 874 | 2.5 | 62% | 79% | 86% |
| | | 0< $r_i$ <100 bp | 28762 | 4.21 | 58% | 68% | 75% |
| | | $r_i$>100 bp | 2246 | 7.01 | 55% | 60% | 64% |

**Table 3 (cont'd) Minimum Shortable Price(MSP) vs. Actual Short Sale Price (9/11/2008-9/18/2008) lagged returns**

| Share Volume Group | Price Group | Return (basis points) | # Obs. | Average Bid Ask Spread | % of Short Sales w/price below MSP (for different increment levels) | | |
|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | | **1 cent** | **2 cents** | **3 cents** |
| Medium | low | $r_i$ < -100 bp | 5996 | 2.29 | 62% | 79% | 88% |
| (.6m-2.3m) | | -100 bp < $r_i$ <0 | 44353 | 1.82 | 65% | 84% | 92% |
| | | $r_i$ =0 | 23822 | 1.2 | 66% | 95% | 98% |
| | | 0< $r_i$ <100 bp | 43056 | 1.84 | 63% | 83% | 92% |
| | | $r_i$>100 bp | 6791 | 2.35 | 60% | 78% | 87% |
| Medium | med | $r_i$ < -100 bp | 3308 | 5.02 | 60% | 66% | 72% |
| (.6m-2.3m) | | -100 bp < $r_i$ <0 | 56220 | 3.02 | 65% | 75% | 83% |
| | | $r_i$ =0 | 4858 | 2.21 | 68% | 83% | 90% |
| | | 0< $r_i$ <100 bp | 55886 | 3.08 | 65% | 75% | 83% |
| | | $r_i$>100 bp | 4216 | 5.11 | 60% | 65% | 72% |
| Medium | high | $r_i$ < -100 bp | 2278 | 9.44 | 55% | 59% | 62% |
| (.6m-2.3m) | | -100 bp < $r_i$ <0 | 57717 | 5.49 | 58% | 66% | 71% |
| | | $r_i$ =0 | 2306 | 3.73 | 62% | 74% | 79% |
| | | 0< $r_i$ <100 bp | 57722 | 5.55 | 58% | 66% | 71% |
| | | $r_i$>100 bp | 3059 | 9.48 | 55% | 59% | 62% |
| Medium | low | $r_i$ < -100 bp | 7970 | 3.06 | 63% | 78% | 87% |
| Low | | -100 bp < $r_i$ <0 | 46141 | 2.32 | 62% | 80% | 91% |
| (180000 | | $r_i$ =0 | 45645 | 1.64 | 60% | 89% | 96% |
| -632000) | | 0< $r_i$ <100 bp | 44820 | 2.3 | 54% | 77% | 90% |
| | | $r_i$>100 bp | 8108 | 3.07 | 53% | 72% | 84% |
| Medium | med | $r_i$ < -100 bp | 4278 | 5.59 | 61% | 66% | 73% |
| Low | | -100 bp < $r_i$ <0 | 66227 | 3.44 | 64% | 72% | 81% |
| (180000 | | $r_i$ =0 | 13391 | 2.51 | 65% | 78% | 88% |
| -632000) | | 0< $r_i$ <100 bp | 65788 | 3.45 | 60% | 69% | 79% |
| | | $r_i$>100 bp | 5147 | 5.54 | 57% | 63% | 71% |
| Medium | high | $r_i$ < -100 bp | 2644 | 11.94 | 56% | 60% | 63% |
| Low | | -100 bp < $r_i$ <0 | 71499 | 6.57 | 60% | 66% | 71% |
| (180000 | | $r_i$ =0 | 4548 | 4.56 | 61% | 71% | 77% |
| -632000) | | 0< $r_i$ <100 bp | 71607 | 6.66 | 58% | 64% | 69% |
| | | $r_i$>100 bp | 3672 | 11.85 | 56% | 60% | 63% |
| Low | low | $r_i$ < -100 bp | 15129 | 11.28 | 66% | 74% | 79% |
| (363 | | -100 bp < $r_i$ <0 | 60360 | 8.63 | 63% | 73% | 81% |
| -180000) | | $r_i$ =0 | 102937 | 8.13 | 63% | 77% | 84% |
| | | 0< $r_i$ <100 bp | 55498 | 8.5 | 58% | 71% | 80% |
| | | $r_i$>100 bp | 13769 | 11.91 | 57% | 67% | 74% |
| Low | med | $r_i$ < -100 bp | 8934 | 24.63 | 65% | 71% | 76% |
| (363 | | -100 bp < $r_i$ <0 | 77851 | 12.09 | 61% | 69% | 77% |
| -180000) | | $r_i$ =0 | 71691 | 17.79 | 58% | 70% | 79% |
| | | 0< $r_i$ <100 bp | 74281 | 12 | 54% | 63% | 74% |
| | | $r_i$>100 bp | 8887 | 24.99 | 51% | 59% | 67% |
| Low | high | $r_i$ < -100 bp | 7596 | 103.35 | 61% | 63% | 66% |
| (363 | | -100 bp < $r_i$ <0 | 107149 | 23.57 | 60% | 64% | 67% |
| -180000) | | $r_i$ =0 | 41957 | 52.55 | 59% | 64% | 69% |
| | | 0< $r_i$ <100 bp | 108213 | 30.42 | 53% | 58% | 62% |
| | | $r_i$>100 bp | 8364 | 122.77 | 51% | 55% | 57% |

## Table 4 - Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008)

This table summarizes the percentage of time the Minimum Shortable Price (MSP) was equal to the best ask price (Panel I) and lower than the best ask price(Panel II) for different price increments, for the dates between September 11th and September 18th 2008. If the latest tick was an uptick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price". If the latest tick was a downtick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price + 1cent". We focused only on ordinary common stocks and we excluded stocks whose price on the day of the analysis was below $1. We grouped stocks by liquidity and price levels. We first classified stocks in five groups by the average number of shares traded in the month of July 2008. Each of these subgroups were then divided into terciles according to the average price level on the trading day. The average price level equaled the time weighted average of the midquote. Best Bid and Offer calculated from Daily TAQ data corresponding to ADF, NASDAQ, NYSE and NYSE Arca. Share Volume Information corresponded to daily averages for July 2008.

**i- MSP=Ask**

| Share Volume Group | Price Group | # Obs | % of the time MSP=Ask (for different increment levels) | | | | | Average Bid Ask Spread | Average Price |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 cent | 2 cents | 3 cents | 4 cents | 5 cents | | |
| High | Low | 65 | 28% | 3% | 0% | 0% | 0% | 1.02 | 9.37 |
| (>7m) | Med | 67 | 16% | 2% | 3% | 1% | 0% | 1.17 | 23.05 |
| | High | 67 | 12% | 6% | 12% | 1% | 2% | 2.37 | 62.30 |
| Medium High | Low | 133 | 28% | 8% | 2% | 1% | 0% | 1.40 | 10.33 |
| (2.3m-7m) | med | 133 | 15% | 5% | 13% | 3% | 1% | 2.25 | 28.58 |
| | high | 134 | 12% | 8% | 18% | 3% | 4% | 4.57 | 64.85 |
| Medium | low | 266 | 28% | 17% | 3% | 4% | 1% | 1.89 | 8.77 |
| (.6m-2.3m) | med | 267 | 14% | 8% | 19% | 10% | 1% | 3.49 | 24.43 |
| | high | 267 | 11% | 9% | 17% | 4% | 8% | 6.49 | 53.14 |
| Medium Low | low | 333 | 33% | 18% | 2% | 3% | 1% | 2.32 | 4.95 |
| (180k-632k) | med | 333 | 14% | 18% | 12% | 12% | 4% | 3.83 | 14.87 |
| | high | 334 | 10% | 8% | 15% | 9% | 6% | 7.53 | 39.77 |
| Low | low | 667 | 12% | 10% | 5% | 8% | 4% | 11.12 | 2.55 |
| (363-180k) | med | 666 | 10% | 12% | 5% | 6% | 5% | 21.31 | 7.74 |
| | high | 667 | 7% | 8% | 8% | 8% | 5% | 50.07 | 31.53 |

## Table 4 (cont'd)- Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008)

**ii- MSP<Ask**

| Share Volume Group | Price Group | # Obs | % of the time MSP<Ask (for different increment levels) | | | | | Average Bid Ask Spread | Average Price |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1 cent | 2 cents | 3 cents | 4 cents | 5 cents | | |
| High | low | 65 | 10% | 2% | 1% | 0% | 0% | 1.02 | 9.37 |
| (>7m) | med | 67 | 30% | 5% | 2% | 1% | 0% | 1.17 | 23.05 |
| | high | 67 | 41% | 31% | 15% | 12% | 9% | 2.37 | 62.30 |
| Medium High | low | 133 | 22% | 7% | 4% | 1% | 1% | 1.40 | 10.33 |
| (2.3m-7m) | med | 133 | 46% | 25% | 11% | 7% | 4% | 2.25 | 28.58 |
| | high | 134 | 59% | 52% | 33% | 27% | 22% | 4.57 | 64.85 |
| Medium | low | 266 | 31% | 17% | 13% | 4% | 2% | 1.89 | 8.77 |
| (.6m-2.3m) | med | 267 | 57% | 41% | 26% | 19% | 10% | 3.49 | 24.43 |
| | high | 267 | 68% | 64% | 49% | 42% | 35% | 6.49 | 53.14 |
| Medium Low | low | 333 | 37% | 20% | 17% | 6% | 5% | 2.32 | 4.95 |
| (180k-632k) | med | 333 | 57% | 46% | 38% | 20% | 12% | 3.83 | 14.87 |
| | high | 334 | 70% | 65% | 56% | 49% | 40% | 7.53 | 39.77 |
| Low | low | 667 | 51% | 44% | 41% | 31% | 28% | 11.12 | 2.55 |
| (363-180k) | med | 666 | 58% | 53% | 51% | 41% | 39% | 21.31 | 7.74 |
| | high | 667 | 71% | 69% | 66% | 61% | 57% | 50.07 | 31.53 |

**Table 5 Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008) contemporaneous returns**

This table summarizes the percentage of time the Minimum Shortable Price (MSP) was equal to, lower than, or higher than the best ask price for different price increments and for different levels of contemporaneous returns, for the dates between September 11th and September 18th 2008. If the latest tick was an uptick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price". If the latest tick was a downtick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price + 1cent". We computed stock returns, $r_{i,}$ in five minute intervals for each stocks and we classified them into the following five categories: 1) $r_i$ < -100 bp; 2) -100 bp < $r_i$ <0;3) $r_i$ =0; 4) 0< $r_i$ <100 bp; 5) $r_i$ >100 bp. We focused only on ordinary common stocks and we excluded stocks whose price on the day of the analysis was below $1. We grouped stocks by liquidity and price levels. We first classified stocks in five groups by the average number of shares traded in the month of July 2008. Each of these subgroups were then divided into terciles according to the average price level on the trading day. The average price level equaled the time weighted average of the midquote. Best Bid and Offer calculated from Daily TAQ data corresponding to ADF, NASDAQ, NYSE and NYSE Arca. Share Volume Information corresponded to daily averages for July 2008.

| Share Volume Group | Price Group | Return (basis points) | # Obs. | % of the time MSP > Ask (for different increment levels) | | | % of the time MSP=Ask (for different increment levels) | | | % of the time MSP<Ask (for different increment levels) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** |
| High (>7m) | Low | $r_i$ < -100 bp | 2419 | 57% | 91% | 97% | 31% | 6% | 0% | 13% | 3% | 2% |
| | | -100 bp < $r_i$ <0 | 10544 | 64% | 96% | 99% | 26% | 3% | 0% | 10% | 1% | 0% |
| | | $r_i$ =0 | 3605 | 50% | 99% | 100% | 43% | 1% | 0% | 7% | 0% | 0% |
| | | 0< $r_i$ <100 bp | 10218 | 64% | 96% | 99% | 26% | 3% | 0% | 10% | 1% | 0% |
| | | $r_i$>100 bp | 2620 | 56% | 91% | 97% | 31% | 6% | 0% | 13% | 4% | 2% |
| High (>7m) | Med | $r_i$ < -100 bp | 1096 | 49% | 83% | 87% | 15% | 4% | 7% | 36% | 13% | 6% |
| | | -100 bp < $r_i$ <0 | 13505 | 55% | 95% | 96% | 16% | 1% | 2% | 29% | 4% | 1% |
| | | $r_i$ =0 | 1709 | 52% | 98% | 99% | 20% | 0% | 1% | 28% | 1% | 0% |
| | | 0< $r_i$ <100 bp | 13372 | 53% | 95% | 96% | 16% | 1% | 2% | 31% | 4% | 1% |
| | | $r_i$>100 bp | 1284 | 47% | 83% | 87% | 15% | 4% | 8% | 38% | 13% | 6% |
| High (>7m) | High | $r_i$ < -100 bp | 1028 | 36% | 48% | 56% | 11% | 7% | 14% | 52% | 45% | 30% |
| | | -100 bp < $r_i$ <0 | 13899 | 49% | 65% | 74% | 11% | 6% | 11% | 40% | 29% | 14% |
| | | $r_i$ =0 | 621 | 70% | 86% | 92% | 9% | 2% | 4% | 22% | 12% | 4% |
| | | 0< $r_i$ <100 bp | 13990 | 48% | 65% | 74% | 12% | 6% | 12% | 41% | 30% | 14% |
| | | $r_i$>100 bp | 1350 | 34% | 46% | 54% | 12% | 8% | 16% | 53% | 46% | 30% |
| Medium High (2.3m -7m) | Low | $r_i$ < -100 bp | 2942 | 43% | 73% | 86% | 31% | 13% | 3% | 27% | 13% | 11% |
| | | -100 bp < $r_i$ <0 | 22663 | 53% | 84% | 94% | 25% | 9% | 2% | 23% | 7% | 4% |
| | | $r_i$ =0 | 9913 | 53% | 96% | 99% | 36% | 3% | 0% | 10% | 1% | 1% |
| | | 0< $r_i$ <100 bp | 21916 | 50% | 84% | 94% | 26% | 9% | 2% | 25% | 7% | 4% |
| | | $r_i$>100 bp | 3406 | 37% | 72% | 86% | 32% | 14% | 3% | 30% | 14% | 11% |
| Medium High (2.3m -7m) | Med | $r_i$ < -100 bp | 1769 | 33% | 51% | 55% | 13% | 7% | 17% | 54% | 42% | 28% |
| | | -100 bp < $r_i$ <0 | 27525 | 42% | 71% | 78% | 15% | 5% | 13% | 44% | 23% | 9% |
| | | $r_i$ =0 | 1797 | 45% | 83% | 89% | 16% | 3% | 8% | 38% | 14% | 4% |
| | | 0< $r_i$ <100 bp | 26939 | 38% | 70% | 77% | 15% | 5% | 13% | 47% | 25% | 9% |
| | | $r_i$>100 bp | 2342 | 29% | 51% | 55% | 13% | 7% | 19% | 58% | 42% | 26% |
| Medium High (2.3m -7m) | High | $r_i$ < -100 bp | 1718 | 25% | 29% | 34% | 10% | 8% | 14% | 66% | 63% | 52% |
| | | -100 bp < $r_i$ <0 | 29112 | 30% | 42% | 51% | 12% | 8% | 18% | 58% | 50% | 31% |
| | | $r_i$ =0 | 874 | 46% | 60% | 71% | 11% | 6% | 13% | 43% | 34% | 15% |
| | | 0< $r_i$ <100 bp | 28762 | 28% | 40% | 49% | 13% | 9% | 19% | 60% | 52% | 32% |
| | | $r_i$>100 bp | 2246 | 22% | 27% | 32% | 10% | 9% | 16% | 67% | 64% | 53% |

**Table 5 (cont'd) Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008) contemporaneous returns**

| Share Volume Group | Price Group | Return (basis points) | # Obs. | % of the time MSP > Ask (for different increment levels) | | | % of the time MSP=Ask (for different increment levels) | | | % of the time MSP<Ask (for different increment levels) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** |
| Medium | Low | $r_i$ < -100 bp | 5996 | 41% | 60% | 75% | 23% | 17% | 4% | 35% | 24% | 21% |
| (.6m-2.3m) | | -100 bp < $r_i$ <0 | 44353 | 42% | 63% | 83% | 26% | 19% | 3% | 33% | 18% | 14% |
| | | $r_i$ =0 | 23822 | 48% | 90% | 97% | 39% | 7% | 1% | 13% | 4% | 3% |
| | | 0< $r_i$ <100 bp | 43056 | 36% | 60% | 81% | 27% | 20% | 3% | 37% | 20% | 15% |
| | | $r_i$>100 bp | 6791 | 31% | 54% | 73% | 26% | 19% | 4% | 42% | 27% | 24% |
| Medium | Med | $r_i$ < -100 bp | 3308 | 29% | 40% | 41% | 11% | 8% | 15% | 60% | 52% | 43% |
| (.6m-2.3m) | | -100 bp < $r_i$ <0 | 56220 | 32% | 54% | 57% | 14% | 8% | 19% | 54% | 38% | 24% |
| | | $r_i$ =0 | 4858 | 35% | 70% | 74% | 19% | 5% | 14% | 46% | 24% | 13% |
| | | 0< $r_i$ <100 bp | 55886 | 26% | 50% | 54% | 14% | 8% | 20% | 60% | 42% | 26% |
| | | $r_i$>100 bp | 4216 | 20% | 33% | 35% | 11% | 8% | 18% | 69% | 59% | 48% |
| Medium | High | $r_i$ < -100 bp | 2278 | 23% | 26% | 28% | 8% | 7% | 11% | 68% | 67% | 61% |
| (.6m-2.3m) | | -100 bp < $r_i$ <0 | 57717 | 23% | 29% | 35% | 11% | 9% | 17% | 66% | 62% | 48% |
| | | $r_i$ =0 | 2306 | 31% | 41% | 50% | 12% | 8% | 18% | 57% | 51% | 33% |
| | | 0< $r_i$ <100 bp | 57722 | 19% | 25% | 31% | 11% | 9% | 18% | 70% | 66% | 51% |
| | | $r_i$>100 bp | 3059 | 16% | 18% | 21% | 9% | 8% | 12% | 75% | 74% | 67% |
| Medium | Low | $r_i$ < -100 bp | 7970 | 41% | 59% | 72% | 21% | 13% | 3% | 39% | 28% | 25% |
| Low | | -100 bp < $r_i$ <0 | 46141 | 33% | 58% | 78% | 29% | 20% | 3% | 37% | 22% | 19% |
| (180k | | $r_i$ =0 | 45645 | 35% | 79% | 92% | 43% | 13% | 1% | 22% | 9% | 7% |
| -632k) | | 0< $r_i$ <100 bp | 44820 | 21% | 52% | 76% | 32% | 22% | 2% | 48% | 26% | 22% |
| | | $r_i$>100 bp | 8108 | 21% | 48% | 66% | 26% | 17% | 3% | 53% | 35% | 31% |
| Medium | Med | $r_i$ < -100 bp | 4278 | 34% | 37% | 45% | 10% | 12% | 8% | 55% | 50% | 47% |
| Low | | -100 bp < $r_i$ <0 | 66227 | 33% | 40% | 53% | 14% | 17% | 12% | 53% | 43% | 35% |
| (180k | | $r_i$ =0 | 13391 | 39% | 50% | 68% | 16% | 20% | 9% | 44% | 30% | 23% |
| -632k) | | 0< $r_i$ <100 bp | 65788 | 23% | 32% | 46% | 13% | 18% | 12% | 63% | 50% | 41% |
| | | $r_i$>100 bp | 5147 | 19% | 23% | 32% | 10% | 14% | 9% | 71% | 63% | 59% |
| Medium | High | $r_i$ < -100 bp | 2644 | 29% | 31% | 32% | 7% | 6% | 9% | 65% | 63% | 59% |
| Low | | -100 bp < $r_i$ <0 | 71499 | 24% | 30% | 32% | 10% | 8% | 15% | 66% | 62% | 53% |
| (180k | | $r_i$ =0 | 4548 | 22% | 37% | 41% | 15% | 9% | 18% | 62% | 53% | 41% |
| -632k) | | 0< $r_i$ <100 bp | 71607 | 16% | 23% | 25% | 11% | 9% | 16% | 74% | 69% | 59% |
| | | $r_i$>100 bp | 3672 | 14% | 17% | 18% | 8% | 7% | 10% | 78% | 76% | 71% |

**Table 5 (cont'd) Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008) contemporaneous returns**

| Share Volume Group | Price Group | Return (basis points) | # Obs. | % of the time MSP > Ask (for different increment levels) | | | % of the time MSP=Ask (for different increment levels) | | | % of the time MSP<Ask (for different increment levels) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** |
| Low | Low | $r_i$ < -100 bp | 15129 | 43% | 46% | 51% | 9% | 8% | 5% | 49% | 46% | 44% |
| (363- | | -100 bp < $r_i$ <0 | 60360 | 35% | 44% | 52% | 11% | 10% | 4% | 53% | 46% | 44% |
| 180000) | | $r_i$ =0 | 102937 | 36% | 49% | 59% | 15% | 11% | 4% | 48% | 40% | 37% |
| | | 0< $r_i$ <100 bp | 55498 | 28% | 39% | 49% | 12% | 10% | 4% | 60% | 50% | 47% |
| | | $r_i$>100 bp | 13769 | 26% | 33% | 40% | 9% | 8% | 4% | 65% | 59% | 56% |
| | Med | $r_i$ < -100 bp | 8934 | 40% | 41% | 45% | 7% | 8% | 5% | 53% | 51% | 50% |
| | | -100 bp < $r_i$ <0 | 77851 | 31% | 34% | 43% | 11% | 13% | 5% | 58% | 53% | 51% |
| | | $r_i$ =0 | 71691 | 29% | 36% | 45% | 14% | 13% | 5% | 57% | 51% | 49% |
| | | 0< $r_i$ <100 bp | 74281 | 22% | 26% | 38% | 12% | 15% | 5% | 66% | 59% | 57% |
| | | $r_i$>100 bp | 8887 | 21% | 25% | 32% | 8% | 9% | 4% | 71% | 66% | 65% |
| | High | $r_i$ < -100 bp | 7596 | 32% | 33% | 34% | 5% | 5% | 5% | 63% | 62% | 61% |
| | | -100 bp < $r_i$ <0 | 107149 | 25% | 27% | 29% | 8% | 8% | 8% | 67% | 65% | 63% |
| | | $r_i$ =0 | 41957 | 24% | 26% | 29% | 9% | 10% | 9% | 67% | 64% | 62% |
| | | 0< $r_i$ <100 bp | 108213 | 15% | 18% | 21% | 9% | 9% | 9% | 76% | 73% | 70% |
| | | $r_i$>100 bp | 8364 | 14% | 16% | 17% | 6% | 6% | 6% | 80% | 78% | 77% |

**Table 6 Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008) lagged returns**

This table summarizes the percentage of time the Minimum Shortable Price (MSP) was equal to, lower than, or higher than the best ask price for different price increments and for different levels of contemporaneous returns, for the dates between September 11th and September 18th 2008. If the latest tick was an uptick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price". If the latest tick was a downtick, MSP was equal to the maximum of "best bid + n cents" and "Last Trade Price + 1cent". We computed stock returns, $r_{i,}$ in five minute intervals for each stocks and we classified them into the following five categories: 1) $r_i$ < -100 bp; 2) -100 bp < $r_i$ <0;3) $r_i$ =0; 4) 0< $r_i$ <100 bp; 5) $r_i$ >100 bp. We focused only on ordinary common stocks and we excluded stocks whose price on the day of the analysis was below $1. We grouped stocks by liquidity and price levels. We first classified stocks in five groups by average number of shares traded in the month of July 2008. Each of these subgroups were then divided into terciles according to the average price level on the trading day. The average price level equaled the time weighted average of the midquote. Best Bid and Offer calculated from Daily TAQ data corresponding to ADF, NASDAQ, NYSE and NYSE Arca. Share Volume Information corresponded to daily averages for July 2008.

| Return (basis points) | | | # Obs. | Average Bid Ask Spread | % of the time MSP > Ask (for different increment levels) | | | % of the time MSP=Ask (for different increment levels) | | | % of the time MSP<Ask (for different increment levels) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** |
| $r_i$ < -100 bp | High | low | 2419 | 0.88 | 56% | 92% | 98% | 32% | 5% | 0% | 12% | 3% | 1% |
| -100 bp < $r_i$ <0 | (>7m) | low | 10544 | 0.98 | 63% | 96% | 100% | 27% | 3% | 0% | 10% | 1% | 0% |
| $r_i$ =0 | | low | 3605 | 0.97 | 51% | 99% | 100% | 42% | 1% | 0% | 7% | 0% | 0% |
| 0< $r_i$ <100 bp | | low | 10218 | 0.99 | 64% | 96% | 100% | 26% | 3% | 0% | 10% | 1% | 0% |
| $r_i$>100 bp | | low | 2620 | 1.04 | 57% | 91% | 98% | 31% | 6% | 0% | 13% | 3% | 2% |
| $r_i$ < -100 bp | | med | 1096 | 1.11 | 49% | 84% | 88% | 15% | 4% | 7% | 36% | 12% | 5% |
| -100 bp < $r_i$ <0 | | med | 13505 | 1.09 | 54% | 95% | 97% | 16% | 1% | 2% | 30% | 4% | 1% |
| $r_i$ =0 | | med | 1709 | 0.98 | 54% | 99% | 99% | 19% | 0% | 0% | 27% | 1% | 0% |
| 0< $r_i$ <100 bp | | med | 13372 | 1.13 | 54% | 95% | 97% | 16% | 1% | 2% | 30% | 4% | 1% |
| $r_i$>100 bp | | med | 1284 | 1.3 | 48% | 84% | 88% | 15% | 4% | 7% | 37% | 12% | 5% |
| $r_i$ < -100 bp | | high | 1028 | 2.88 | 36% | 48% | 56% | 12% | 7% | 15% | 52% | 44% | 29% |
| -100 bp < $r_i$ <0 | | high | 13899 | 2.17 | 49% | 65% | 75% | 11% | 6% | 11% | 40% | 29% | 14% |
| $r_i$ =0 | | high | 621 | 1.32 | 69% | 86% | 92% | 9% | 3% | 5% | 22% | 12% | 3% |
| 0< $r_i$ <100 bp | | high | 13990 | 2.27 | 48% | 65% | 75% | 12% | 6% | 11% | 40% | 29% | 14% |
| $r_i$>100 bp | | high | 1350 | 3.43 | 35% | 46% | 54% | 12% | 8% | 16% | 54% | 46% | 30% |
| $r_i$ < -100 bp | Medium | low | 2942 | 1.61 | 39% | 74% | 87% | 33% | 14% | 3% | 27% | 13% | 10% |
| -100 bp < $r_i$ <0 | High | low | 22663 | 1.28 | 51% | 85% | 94% | 26% | 9% | 2% | 23% | 7% | 4% |
| $r_i$ =0 | (2.3m- | low | 9913 | 1.05 | 54% | 96% | 99% | 36% | 3% | 0% | 10% | 1% | 1% |
| 0< $r_i$ <100 bp | 7m) | low | 21916 | 1.3 | 51% | 85% | 94% | 25% | 9% | 2% | 23% | 7% | 4% |
| $r_i$>100 bp | | low | 3406 | 1.62 | 40% | 74% | 88% | 32% | 14% | 3% | 28% | 13% | 9% |
| $r_i$ < -100 bp | | med | 1769 | 3.15 | 30% | 50% | 54% | 14% | 8% | 19% | 57% | 42% | 27% |
| -100 bp < $r_i$ <0 | | med | 27525 | 1.95 | 40% | 71% | 78% | 15% | 5% | 13% | 45% | 24% | 8% |
| $r_i$ =0 | | med | 1797 | 1.56 | 45% | 83% | 89% | 16% | 3% | 8% | 39% | 14% | 3% |
| 0< $r_i$ <100 bp | | med | 26939 | 1.98 | 40% | 71% | 78% | 15% | 5% | 13% | 45% | 24% | 8% |
| $r_i$>100 bp | | med | 2342 | 3.04 | 31% | 52% | 57% | 14% | 8% | 19% | 55% | 40% | 24% |
| $r_i$ < -100 bp | | high | 1718 | 6.64 | 23% | 28% | 32% | 10% | 9% | 16% | 67% | 63% | 52% |
| -100 bp < $r_i$ <0 | | high | 29112 | 4.07 | 29% | 41% | 50% | 12% | 8% | 18% | 58% | 51% | 31% |
| $r_i$ =0 | | high | 874 | 2.5 | 45% | 59% | 71% | 12% | 7% | 14% | 43% | 34% | 15% |
| 0< $r_i$ <100 bp | | high | 28762 | 4.21 | 29% | 41% | 50% | 12% | 8% | 18% | 58% | 51% | 32% |
| $r_i$>100 bp | | high | 2246 | 7.01 | 23% | 28% | 32% | 10% | 9% | 16% | 67% | 64% | 52% |

**Table 6 (Cont'd) Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008) lagged returns**

| Return (basis points) | | | # Obs. | Average Bid Ask Spread | % of the time MSP > Ask (for different increment levels) | | | % of the time MSP=Ask (for different increment levels) | | | % of the time MSP<Ask (for different increment levels) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Price increment for rule:** | | | | | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** | **1 cent** | **2 cents** | **3 cents** |
| $r_i$ < -100 bp | Medium | low | 5996 | 2.29 | 35% | 56% | 75% | 26% | 19% | 4% | 39% | 25% | 22% |
| -100 bp < $r_i$ <0 | (.6m- | low | 44353 | 1.82 | 39% | 62% | 83% | 26% | 19% | 3% | 34% | 19% | 14% |
| $r_i$ =0 | 2.3m) | low | 23822 | 1.2 | 49% | 89% | 97% | 38% | 7% | 1% | 13% | 4% | 3% |
| 0< $r_i$ <100 bp | | low | 43056 | 1.84 | 38% | 62% | 82% | 27% | 20% | 3% | 35% | 19% | 14% |
| $r_i$>100 bp | | low | 6791 | 2.35 | 35% | 56% | 75% | 27% | 19% | 4% | 38% | 25% | 21% |
| $r_i$ < -100 bp | | med | 3308 | 5.02 | 23% | 35% | 37% | 12% | 9% | 18% | 65% | 56% | 45% |
| -100 bp < $r_i$ <0 | | med | 56220 | 3.02 | 29% | 53% | 56% | 14% | 8% | 20% | 57% | 40% | 24% |
| $r_i$ =0 | | med | 4858 | 2.21 | 35% | 70% | 73% | 18% | 5% | 14% | 47% | 25% | 13% |
| 0< $r_i$ <100 bp | | med | 55886 | 3.08 | 29% | 52% | 55% | 14% | 8% | 20% | 57% | 40% | 25% |
| $r_i$>100 bp | | med | 4216 | 5.11 | 24% | 36% | 38% | 12% | 9% | 18% | 64% | 55% | 44% |
| $r_i$ < -100 bp | | high | 2278 | 9.44 | 19% | 21% | 24% | 10% | 9% | 13% | 72% | 70% | 64% |
| -100 bp < $r_i$ <0 | | high | 57717 | 5.49 | 21% | 28% | 34% | 11% | 9% | 18% | 68% | 63% | 49% |
| $r_i$ =0 | | high | 2306 | 3.73 | 32% | 42% | 50% | 12% | 8% | 17% | 57% | 50% | 33% |
| 0< $r_i$ <100 bp | | high | 57722 | 5.55 | 21% | 27% | 33% | 11% | 9% | 18% | 68% | 64% | 49% |
| $r_i$>100 bp | | high | 3059 | 9.48 | 18% | 21% | 23% | 9% | 8% | 12% | 72% | 71% | 64% |
| $r_i$ < -100 bp | Medium | low | 7970 | 3.06 | 31% | 54% | 70% | 24% | 16% | 3% | 45% | 30% | 26% |
| -100 bp < $r_i$ <0 | Low | low | 46141 | 2.32 | 30% | 57% | 78% | 31% | 21% | 3% | 40% | 22% | 19% |
| $r_i$ =0 | (180000 | low | 45645 | 1.64 | 35% | 77% | 91% | 41% | 13% | 1% | 24% | 10% | 8% |
| 0< $r_i$ <100 bp | -632000) | low | 44820 | 2.3 | 24% | 55% | 77% | 32% | 22% | 3% | 44% | 24% | 20% |
| $r_i$>100 bp | | low | 8108 | 3.07 | 27% | 52% | 69% | 26% | 18% | 4% | 47% | 31% | 27% |
| $r_i$ < -100 bp | | med | 4278 | 5.59 | 25% | 28% | 37% | 11% | 15% | 9% | 64% | 57% | 53% |
| -100 bp < $r_i$ <0 | | med | 66227 | 3.44 | 30% | 37% | 51% | 14% | 18% | 12% | 57% | 45% | 37% |
| $r_i$ =0 | | med | 13391 | 2.51 | 39% | 49% | 67% | 16% | 19% | 9% | 46% | 31% | 24% |
| 0< $r_i$ <100 bp | | med | 65788 | 3.45 | 27% | 35% | 49% | 14% | 18% | 12% | 59% | 47% | 39% |
| $r_i$>100 bp | | med | 5147 | 5.54 | 23% | 27% | 36% | 12% | 15% | 10% | 65% | 58% | 53% |
| $r_i$ < -100 bp | | high | 2644 | 11.94 | 20% | 23% | 24% | 8% | 7% | 10% | 72% | 70% | 66% |
| -100 bp < $r_i$ <0 | | high | 71499 | 6.57 | 21% | 27% | 30% | 10% | 8% | 16% | 69% | 64% | 55% |
| $r_i$ =0 | | high | 4548 | 4.56 | 23% | 37% | 41% | 14% | 9% | 18% | 63% | 54% | 41% |
| 0< $r_i$ <100 bp | | high | 71607 | 6.66 | 19% | 26% | 28% | 11% | 9% | 16% | 70% | 66% | 56% |
| $r_i$>100 bp | | high | 3672 | 11.85 | 19% | 22% | 23% | 8% | 7% | 11% | 73% | 71% | 66% |

**Table 6 (Cont'd) Minimum Shortable Price(MSP) vs. Best Ask Price (9/11/2008-9/18/2008) lagged returns**

| Return (basis points) | | | # Obs. | Average Bid Ask Spread | % of the time MSP > Ask (for different increment levels) | | | % of the time MSP=Ask (for different increment levels) | | | % of the time MSP<Ask (for different increment levels) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Price increment for rule: | | | 1 cent | 2 cents | 3 cents | 1 cent | 2 cents | 3 cents | 1 cent | 2 cents | 3 cents |
| $r_i$ < -100 bp | Low | low | 15129 | 11.28 | 38% | 43% | 48% | 9% | 9% | 5% | 53% | 49% | 47% |
| -100 bp < $r_i$ <0 | (363 | low | 60360 | 8.63 | 34% | 43% | 51% | 11% | 10% | 4% | 55% | 48% | 45% |
| $r_i$ =0 | -180000) | low | 102937 | 8.13 | 36% | 49% | 58% | 15% | 11% | 4% | 49% | 40% | 38% |
| 0< $r_i$ <100 bp | | low | 55498 | 8.5 | 29% | 40% | 50% | 13% | 11% | 5% | 58% | 49% | 45% |
| $r_i$>100 bp | | low | 13769 | 11.91 | 27% | 34% | 41% | 10% | 9% | 5% | 63% | 57% | 54% |
| $r_i$ < -100 bp | | med | 8934 | 24.63 | 34% | 36% | 41% | 8% | 9% | 5% | 58% | 55% | 54% |
| -100 bp < $r_i$ <0 | | med | 77851 | 12.09 | 29% | 33% | 43% | 11% | 13% | 5% | 59% | 54% | 52% |
| $r_i$ =0 | | med | 71691 | 17.79 | 29% | 35% | 45% | 14% | 13% | 5% | 57% | 51% | 50% |
| 0< $r_i$ <100 bp | | med | 74281 | 12 | 23% | 27% | 39% | 12% | 15% | 6% | 65% | 58% | 56% |
| $r_i$>100 bp | | med | 8887 | 24.99 | 23% | 26% | 33% | 9% | 10% | 4% | 68% | 64% | 62% |
| $r_i$ < -100 bp | | high | 7596 | 103.35 | 27% | 27% | 28% | 5% | 6% | 5% | 68% | 67% | 66% |
| -100 bp < $r_i$ <0 | | high | 107149 | 23.57 | 23% | 25% | 28% | 8% | 8% | 8% | 69% | 67% | 64% |
| $r_i$ =0 | | high | 41957 | 52.55 | 24% | 26% | 29% | 9% | 9% | 8% | 68% | 65% | 63% |
| 0< $r_i$ <100 bp | | high | 108213 | 30.42 | 17% | 19% | 22% | 9% | 9% | 10% | 74% | 72% | 68% |
| $r_i$>100 bp | | high | 8364 | 122.77 | 17% | 18% | 20% | 6% | 6% | 6% | 77% | 75% | 74% |

**Table 7-A**
**Stocks: Three sampled stocks from each subgroup of stocks**
**Period: 09/12/2008-09/18/2008**

This table summarizes the probability that an order would execute and the time to execution when we simulated the submission of a short sell order for a group of 9 stocks of the highly traded group (>7ml shares). The price and the volume categories for the stocks are as described in the main text of the memo. For each of these groups, 3 stocks belonged to each of the price categories (high, medium and low price). We used the Daily TAQ's trade and quote reports for ARCA to simulate the market condition.
exec= percentage of the simulation which a short sale is executed.
sec = time to execution in seconds (for simulations that result in an execution).

| Share Volume Group | Price Group | Return (basis points) | # Obs | Liquidity Provider | | 1 cent bid increment + uptick | | 2 cents bid increment + uptick | | 3 cents bid increment + uptick | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | exec | sec | exec | sec | exec | sec | exec | sec |
| High (>7m) | low | $r_i$ < -100 bp | 410 | 68% | 8.50 | 64% | 10.62 | 52% | 15.79 | 33% | 22.37 |
| | | -100 bp < $r_i$ <0 | 2285 | 66% | 12.94 | 61% | 14.88 | 46% | 20.42 | 18% | 26.37 |
| | | $r_i$ =0 | 509 | 60% | 16.61 | 57% | 18.87 | 34% | 22.08 | 7% | 34.31 |
| | | 0< $r_i$ <100 bp | 2044 | 79% | 13.27 | 76% | 15.29 | 60% | 20.39 | 20% | 27.22 |
| | | $r_i$>100 bp | 600 | 94% | 8.24 | 91% | 9.64 | 85% | 14.18 | 56% | 21.38 |
| High (>7m) | medium | $r_i$ < -100 bp | 285 | 80% | 4.80 | 73% | 6.61 | 63% | 9.70 | 51% | 19.30 |
| | | -100 bp < $r_i$ <0 | 3395 | 78% | 8.49 | 75% | 11.33 | 65% | 16.25 | 28% | 25.54 |
| | | $r_i$ =0 | 300 | 83% | 8.74 | 77% | 13.00 | 63% | 19.22 | 22% | 28.50 |
| | | 0< $r_i$ <100 bp | 3049 | 90% | 8.42 | 88% | 10.98 | 81% | 16.48 | 35% | 25.65 |
| | | $r_i$>100 bp | 380 | 97% | 6.52 | 94% | 8.59 | 92% | 11.02 | 76% | 20.43 |
| High (>7m) | high | $r_i$ < -100 bp | 215 | 95% | 2.15 | 88% | 3.41 | 86% | 4.27 | 80% | 5.98 |
| | | -100 bp < $r_i$ <0 | 1981 | 87% | 6.41 | 81% | 8.89 | 71% | 12.30 | 57% | 14.79 |
| | | $r_i$ =0 | 110 | 91% | 9.25 | 86% | 11.76 | 65% | 20.27 | 29% | 26.46 |
| | | 0< $r_i$ <100 bp | 1710 | 93% | 5.72 | 89% | 8.05 | 83% | 11.45 | 70% | 15.14 |
| | | $r_i$>100 bp | 275 | 99% | 2.20 | 99% | 3.39 | 98% | 4.60 | 97% | 5.45 |

**Table 7-B**
**Stocks: Three sampled stocks from each subgroup of stocks**
**Period: 09/12/2008-09/18/2008**
This table summarizes the probability that an order would execute and the time to execution when we simulated the submission of a short sell order for a group of 9 stocks of the medium traded group (more than .6m less than2.3m shares). The price and the volume categories for the stocks are as described in the main text of the memo. For each of these groups, 3 stocks belonged to each of the price categories (high, medium and low price). We used the Daily TAQ's trade and quote reports for ARCA to simulate the market condition.
exec= percentage of the simulation which a short sale is executed.
sec = time to execution in seconds (for simulations that result in an execution).

| Share Volume Group | Price Group | Return (basis points) | # Obs | Liquidity Provider | | 1 cent bid increment + uptick | | 2 cents bid increment + uptick | | 3 cents bid increment + uptick | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | exec | sec | exec | sec | exec | sec | exec | sec |
| Medium (.6m-2.3m) | low | $r_i$ < -100 bp | 250 | 52% | 13.71 | 36% | 14.39 | 26% | 17.81 | 15% | 19.12 |
| | | -100 bp < $r_i$ <0 | 2236 | 45% | 16.69 | 31% | 19.03 | 19% | 22.32 | 11% | 25.52 |
| | | $r_i$ =0 | 816 | 30% | 19.89 | 23% | 20.87 | 7% | 25.78 | 1% | 34.71 |
| | | 0< $r_i$ <100 bp | 2228 | 69% | 16.88 | 57% | 20.02 | 39% | 24.01 | 21% | 25.72 |
| | | $r_i$>100 bp | 299 | 92% | 10.69 | 85% | 14.40 | 72% | 19.92 | 42% | 24.10 |
| Medium (.6m-2.3m) | medium | $r_i$ < -100 bp | 239 | 83% | 11.03 | 61% | 14.75 | 59% | 15.60 | 54% | 16.69 |
| | | -100 bp < $r_i$ <0 | 2280 | 76% | 13.02 | 56% | 17.03 | 51% | 18.85 | 42% | 20.54 |
| | | $r_i$ =0 | 135 | 76% | 13.02 | 61% | 16.14 | 53% | 17.93 | 40% | 21.13 |
| | | 0< $r_i$ <100 bp | 2099 | 87% | 13.01 | 72% | 16.55 | 68% | 18.67 | 59% | 20.51 |
| | | $r_i$>100 bp | 305 | 95% | 9.68 | 87% | 14.25 | 86% | 14.86 | 83% | 16.54 |
| Medium (.6m-2.3m) | high | $r_i$ < -100 bp | 94 | 83% | 8.80 | 64% | 15.46 | 59% | 16.99 | 57% | 18.54 |
| | | -100 bp < $r_i$ <0 | 3218 | 79% | 11.38 | 61% | 15.25 | 55% | 17.18 | 47% | 19.14 |
| | | $r_i$ =0 | 165 | 87% | 13.85 | 72% | 17.93 | 65% | 21.29 | 53% | 26.07 |
| | | 0< $r_i$ <100 bp | 3054 | 89% | 11.32 | 77% | 15.28 | 72% | 17.41 | 66% | 19.43 |
| | | $r_i$>100 bp | 95 | 97% | 7.54 | 94% | 11.10 | 93% | 14.23 | 89% | 14.90 |