

S7-10-04

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Memorandum

To: The File

From: Office of Economic Analysis

Subject: Description of October 2003 Analysis of Subpenny Trade Patterns

Date: February 24, 2004

Contact: Larry Harris  
Lois Lightfoot

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OEA's preliminary findings of subpenny trade patterns show that subpenny trades cluster on the one-tenth penny and nine-tenth penny price points. The purpose of this analysis is to help evaluate the establishment of a minimum trade and quotation increment.

Summary statistics that describe our findings based on trade data for the week April 21-25, 2003 are presented in the attached charts and tables.

A primary concern is that subpenny quotes are used to gain priority over other essentially same-priced orders. While the display of better priced orders is usually encouraged, prices that are not meaningfully better can establish priority in systems that recognize sufficiently small increments. By examining the clustering patterns of subpenny trades we can assess how subpennies are used.

The use of subpennies to gain priority at the lowest possible cost will cluster prices at one-tenth penny as buyers try to gain priority over bid prices and at nine-tenth penny as sellers try to gain priority over ask prices. Alternatively, as explained in a study by Harris<sup>1</sup>, clustering on mid-point prices and larger increments reflects 'the use of discrete price sets by traders...[to] minimize negotiation costs.' Uniform subpenny usage may indicate that sub-pennies are used in the price discovery process.

### Findings

- Subpenny trades accounted for 12.9% of trades in Nasdaq listed issues, 9.8% of trades in Amex issues, and 1.0% of trades in NYSE issues in the sample week (Table 1). ETFs trades reported as CSE or Nasdaq executions accounted for the majority of Amex subpenny trades. Most subpenny trades in NYSE issues were also reported as Nasdaq trades. Because subpenny trading occurs on ECNs, we

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<sup>1</sup> Harris, L., 1991, "Stock Price Clustering and Discreteness," The Review of Financial Studies, v4, n3, 389-415.

see the resulting executions as trade reports on the CSE, Nasdaq, and the ADF where ECNs report trades.

- We find that subpenny trades cluster on the one-tenth penny and nine-tenth penny price points, as shown in Chart 1. In Nasdaq issues, 25.1% of subpenny trades executed at one-tenth penny and 24.3% of subpenny trades executed at nine-tenth penny, for a combined total of 49.4%. As measured by share volume, 38.1% of subpenny volume was executed at the one or nine tenth penny price points (Chart 2). The share volume data shows some clustering at the mid-point, which probably is due to trade reports from mid-quote pricing systems that serve institutional traders. These patterns are consistent with the use of subpenny pricing to gain priority over existing quotes.
- Another 12% of subpenny trades occurred in hundredth of pennies (4 digits), and about one-half of these trades occurred at the most extreme price points of  $1/100^{\text{th}}$  or  $99/100^{\text{th}}$  of one penny.

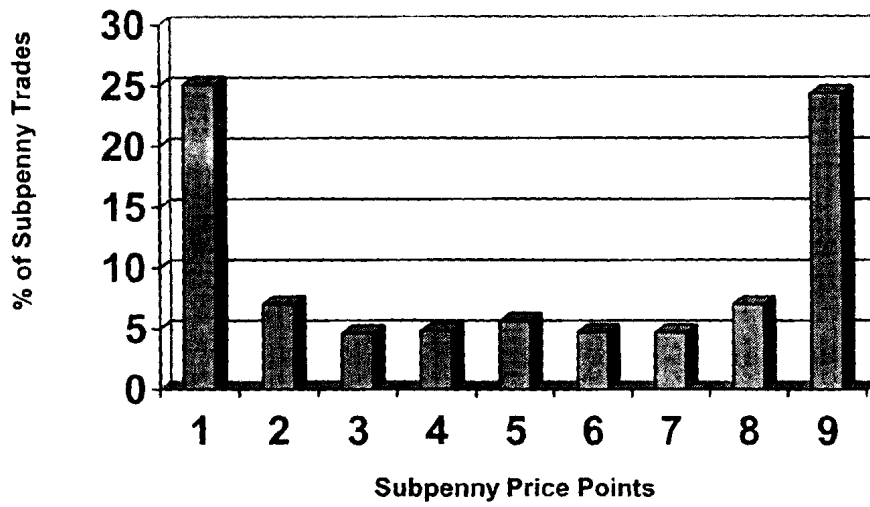
(For purposes of comparison, Chart 3 shows the pattern of trades prices across penny increments. Chart 3 clearly shows price clustering on nickel increments, with a preference for zero, fifty cents, quarters, and dimes. Finer increments, (penny increments that are not nickel multiples) are used less frequently. However, even in this aggregated data, there is some evidence that 1 cent, 99 and 98 cent trades occur more frequently than other non-nickel increments.)

- We also examined the frequency of subpenny trades by price level (Table 3). The data show that the overall frequency of subpenny trades and the level of subpenny clustering is approximately the same at all price levels. For example, 10.5% of trades priced less than \$1.00 were executed in subpenny increments compared to 11.5% of trades priced greater than \$60. The fraction of subpenny trades executed at the one and nine tenths of a cent price points was close to 50% for all price levels. These results suggest that subpenny prices are generated by proprietary trading algorithms. In all other markets, traders tend to use minor price points more often for lower price securities. Our failure to find this pervasively common relation suggests that the subpenny phenomenon for most stocks is far more likely related to precedence issues than to price discovery issues.
- However, we do find that subpenny trades occur more frequently for actively traded stocks. In the 20 most active Nasdaq stocks (measured by share volume), 22.1% of trades were executed in subpennies and subpenny trades occur less frequently as trading activity declines. Subpenny clustering on 1s and 9s occur at each trade activity level.

These findings shows that subpenny trades cluster on ones and nines, and that subpenny trading occurs more frequently in actively traded stocks. This initial analysis does not

show that subpenny trading is related to stock price, however, we continue to examine these issues.

**Chart 1**  
**Frequency of Subpenny Trades by Subpenny Price Point**  
**Nasdaq Stocks, April 21-25, 2003**



**Chart 2**  
**Subpenny Share Volume by Subpenny Price Point**  
**Nasdaq Stocks, April 21-25, 2003**

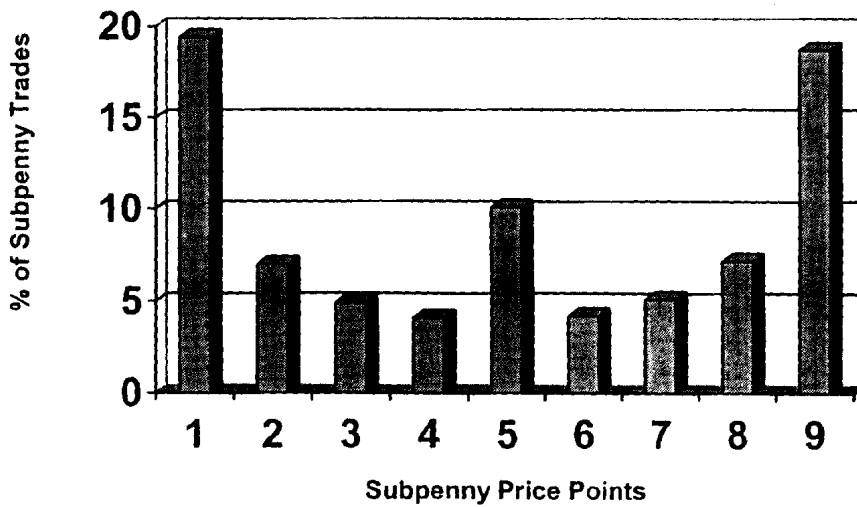
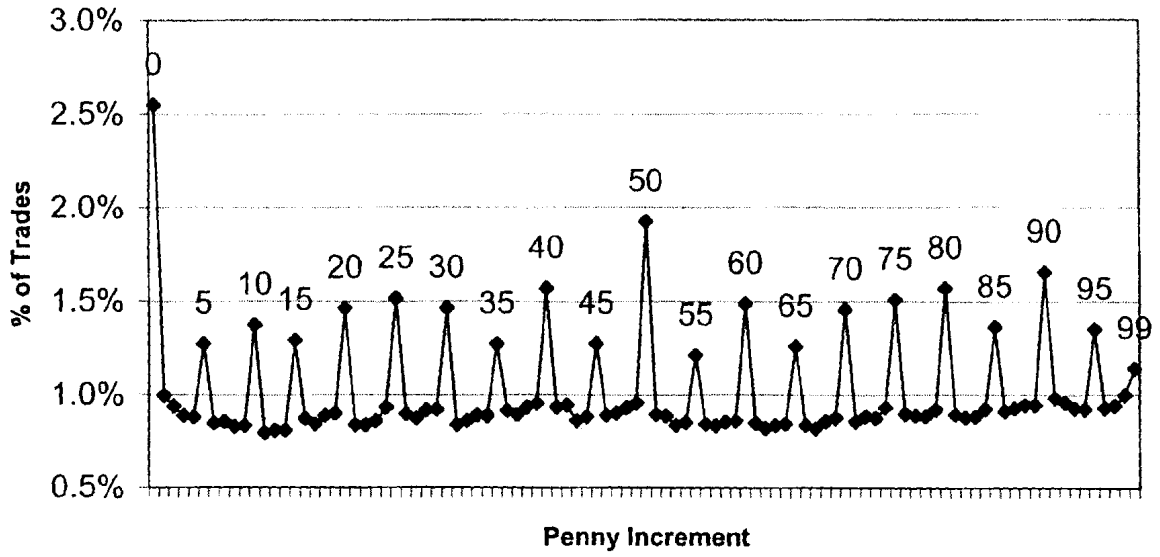


Chart 3  
Frequency of Trades on Penny Price Points  
Nasdaq Stocks, April 21-25, 2003



Subpenny Trading  
(April 21-25, 2003)

Table 1  
Frequency of Subpenny Executions on Amex, NYSE, and Nasdaq Stocks

Stocks Listed on:	% of Trades in Subpennies	% of Share Volume in Subpennies	Subpenny Trades (000s)	Subpenny Share Volume (millions)	Average Trade Size	
					Subpenny Trades	Penny Trades
Amex 1/	9.8	6.8	54	72	1,314	1,970
NYSE	1.0	1.8	81	154	1,898	1,117
Nasdaq	12.9	11.9	1,635	905	553	607

1/ ETF trades account for the majority of subpenny trades in Amex issues.

Table 2  
*Panel A: Percent of Subpenny Trades On Subpenny Increments*

	.001	.002	.003	.004	.005	.006	.007	.008	.009	.0001 and .0009	All other hundredth increments	Total Sub-Penny Trades
Nasdaq	25.1	7.0	4.6	4.8	5.6	4.7	4.7	7.0	24.3	5.6	6.6	100%
Amex	15.2	10.1	9.1	8.2	9.1	8.9	9.0	10.0	19.4	0.7	9.3	100%
NYSE	18.9	10.1	2.6	3.3	7.8	2.9	2.5	10.8	18.3	0.5	22.3	100%

*Panel B: Percent of Subpenny Share Volume On Subpenny Increments*

	.001	.002	.003	.004	.005	.006	.007	.008	.009	.0001 and .0009	All other hundredth increments	Total Sub-Penny Trades
Nasdaq	19.4	7.0	4.9	4.1	10.1	4.2	5.1	7.2	18.7	3.4	15.9	100%
Amex	18.9	8.2	7.6	7.5	10.6	7.8	8.1	10.0	14.4	0.1	6.8	100%
NYSE	3.9	2.0	1.5	1.1	17.2	1.0	0.7	2.3	3.7	3.8	62.8	100%

Table 3

*Panel A: Frequency of Subpenny Trades by Price Level for Nasdaq Stocks*

Trade Price	Percent of Trades Executed in Subpennies	Percent of Subpenny Trades at 1/10 or 9/10 <sup>th</sup> cent	Total Number of Trades (000s)
< \$1.00	10.5	47.8	461
\$1-\$10	13.1	53.0	3,309
\$10-\$20	15.2	48.6	3,762
\$20-\$40	11.4	47.9	4,058
\$40-\$60	10.9	45.6	806
Over \$60	11.5	50.4	268

*Panel B: Subpenny Share Volume by Price Level for Nasdaq Stocks*

Trade Price	Percent of Volume Executed in Subpennies	Percent of Subpenny Share Volume at 1/10 or 9/10 <sup>th</sup> cent	Total Share Volume (000s)
< \$1.00	10.7	36.1	777,500
\$1-\$10	11.9	39.1	2,428,000
\$10-\$20	13.6	37.5	2,258,000
\$20-\$40	10.4	38.3	1,760,000
\$40-\$60	11.1	36.9	268,700
Over \$60	11.0	46.5	108,800

Table 4

*Panel A: Frequency of Subpenny Trades by Stock Activity Level*  
 Nasdaq Stocks

Stocks by Share Volume	Percent of Trades Executed in Subpennies	Percent of Subpenny Trades at 1/10 or 9/10 <sup>th</sup> cent	Total Number of Trades (000s)
Top 20	22.1	44.5	3,205
21-100	14.4	51.2	3,577
101-1000	7.2	54.2	5,245
10001 +	4.8	74.7	637

*Panel B: Subpenny Share Volume by Stock Activity Level*  
 Nasdaq Stocks

Stocks by Share Volume	Percent of Share Volume Executed in Subpennies	Percent of Subpenny Trades at 1/10 or 9/10 <sup>th</sup> cent	Total Share Volume (000s)
Top 20	18.0	38.9	2,650,000
21-100	11.5	40.6	2,112,000
101-1000	6.8	32.4	2,562,000
10001 +	1.4	42.2	275,400



Table 5  
Subpenny Executions in Nasdaq Stocks by Reporting Market

Trade Reported on:	% of Market Trades in Subpennies	% of Market Share Volume in Subpennies	Subpenny Trades (000s)	Subpenny Share Volume
Amex	0.0	0	0	0
CSE	40.2	36.1	832	340,600
ADF	16.2	18.0	187	83,400
CHX	2.1	0.9	2	677
PCX	.03	.05	.6	451
Nasdaq	8.7	9.3	613	479,800

## Rule-Comments

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**From:** Butler, Ronesha  
**Sent:** Tuesday, March 02, 2004 3:04 PM  
**To:** Rule-Comments  
**Cc:** Campion, Kevin J.  
**Subject:** For inclusion in File No. S7-10-04



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