



International Securities Exchange

Penny Pilot Analysis

Version 1.0

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Chapter 1. Summary

1.1. Background

On Friday, January 26th, 2007, the options exchanges commenced a pilot to quote and trade options in one-cent increments. The Pilot consists of options on 13 stocks and ETFs, covering a full range of trading characteristics. The Pilot is being conducted with quotation and trading increments of one-cent for options trading at less than \$3.00, and increments of five-cents for options trading at \$3.00 or more except for options on QQQQ, which trades in one-cent increments at all price levels.

As part of the Pilot, the International Securities Exchange, LLC ("ISE" or the "Exchange") committed to provide to the Commission this report, which analyzes the impact of the Pilot on the market.

The report provides information relating to quality of markets, capacity, and operational issues. This report also provides recommendations for next steps following the Pilot.

1.2. Summary and Recommendation

We recommend that the Commission be very cautious in any expansion of penny quoting. With respect to spreads, the Penny Pilot may have produced benefits for retail investors. However, ISE has significant concerns regarding the overall effect of the Pilot on the options market. Although market spreads have narrowed, the size at the National Best Bid Offer (NBBO) has declined significantly. While the remaining size may be sufficient for retail customer orders, it is not sufficient for institutional customers.

In the two high liquidity symbols, QQQQ and IWM, there was a significant increase in volume; however, we saw that the spread in these instruments was often one cent wide and sometimes the markets were locked. We suspect that much of the increase was the result of Market Maker systems locking with each other. We observed a trailing off in volume in the last month, which we attribute to market makers tuning their systems for quoting in a penny market. Indeed, recently the volume increase in these high liquidity symbols was more in line with similar products that were not traded in pennies.

With respect to quotation traffic, the increase in internal quote traffic sent by market makers to the ISE has doubled, and in the QQQQs, which quotes in pennies at all price levels, the number of quotes has tripled. This raises a "caution flag" regarding expansion of the Pilot. In this regard, to process quotes in pennies up to \$3.00 will require that quoting capacity be doubled. Should the Pilot be expanded, ISE will need a reasonable lead time to build out its capacity and test with our members. The equipment necessary to handle this quotation load will be at a considerable additional cost to the Exchange.

We further believe that the cost to the industry to process quoting in pennies at all price levels is not justified. We specifically note that only two percent of all trades in QQQQ were in options above \$3.00. To process quotes in pennies at all price levels will require that ISE quoting capacity be tripled. Such an increase will be extremely costly to ISE and its members and will take much longer to implement. Thus, to minimize this impact to capacity, ISE recommends that if any expansion be considered, that it be implemented in one-cent and five-cent increments, not in pennies at all price levels.

It is critical to note that we were able to analyze only the effect of penny quoting on our systems and the quotations and transactions in our market. While we could not analyze the effect of pennies on our market makers, we do have concerns regarding market makers due to the reduction in spreads. The options market is quotation-driven, and unlike the underlying equity

market, it is highly dependent on market makers supplying liquidity – through continuous quotations – in tens of thousands of series. If the reduction in spreads leads to contraction in the market making community similar to what occurred in the equity market, we are concerned that there will be less liquidity available to market participants, driving interest in off-exchange, non-transparent trading.

We are also concerned about the effect of reduced size on institutional participants. Institutions have become significant participants in the options market in the last few years due to the large size available in the options market relative to that available in the underlying equity market. The dramatic reduction in size of almost 80% may force institutional investors to seek liquidity outside of the market (“upstairs”), where there is no transparency and where they are not limited to trading within the NBBO. Expanding the Penny Pilot could adversely affect market liquidity, jeopardizing the continued participation of institutions in exchange traded options.

We urge the Commission to study the effect of the Pilot on market makers, institutions and overall liquidity implications before engaging in any expansion of the Pilot. In the event that the Commission does decide to expand the Pilot after such a study, we propose that pennies be confined to relatively few symbols where there is: high liquidity in the underlying symbol; low underlying value; and high retail-investor appeal.

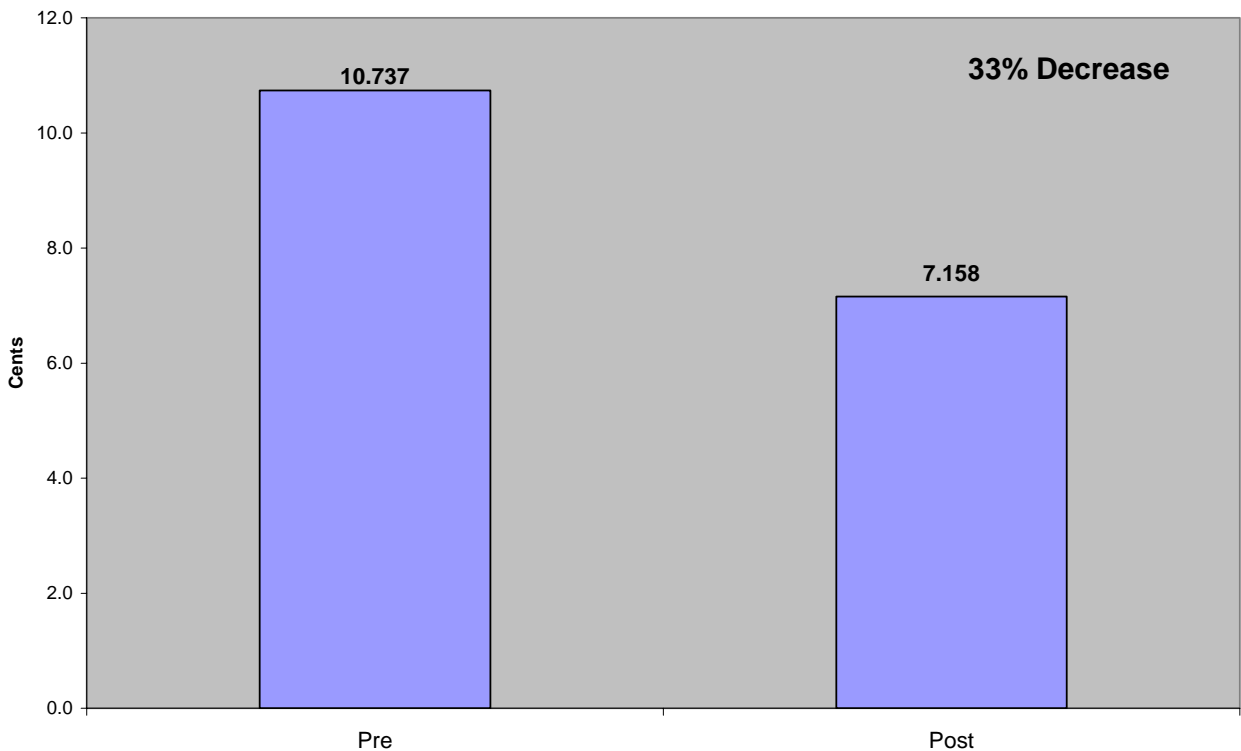
Chapter 2. Quality of Markets

2.1. Best Bid Offer Spread

We send the ISE's BBO for each option series to the Options Price Reporting Authority ("OPRA"), and OPRA then calculates the NBBO for dissemination to the market. The difference between the BBO, commonly referred to as the Spread is a measure of the quality of the market.

The following graph shows the change in the ISE average spread of the 13 pilot options in the three month period prior to the Pilot start (Oct 25th 2006 – Jan 25th 2007) versus the first three months of trading in the options pursuant to the Pilot (Feb 9th 2007 – May 9th 2007).

ISE Spread Pre vs. Post: All Names (Volume Weighted)

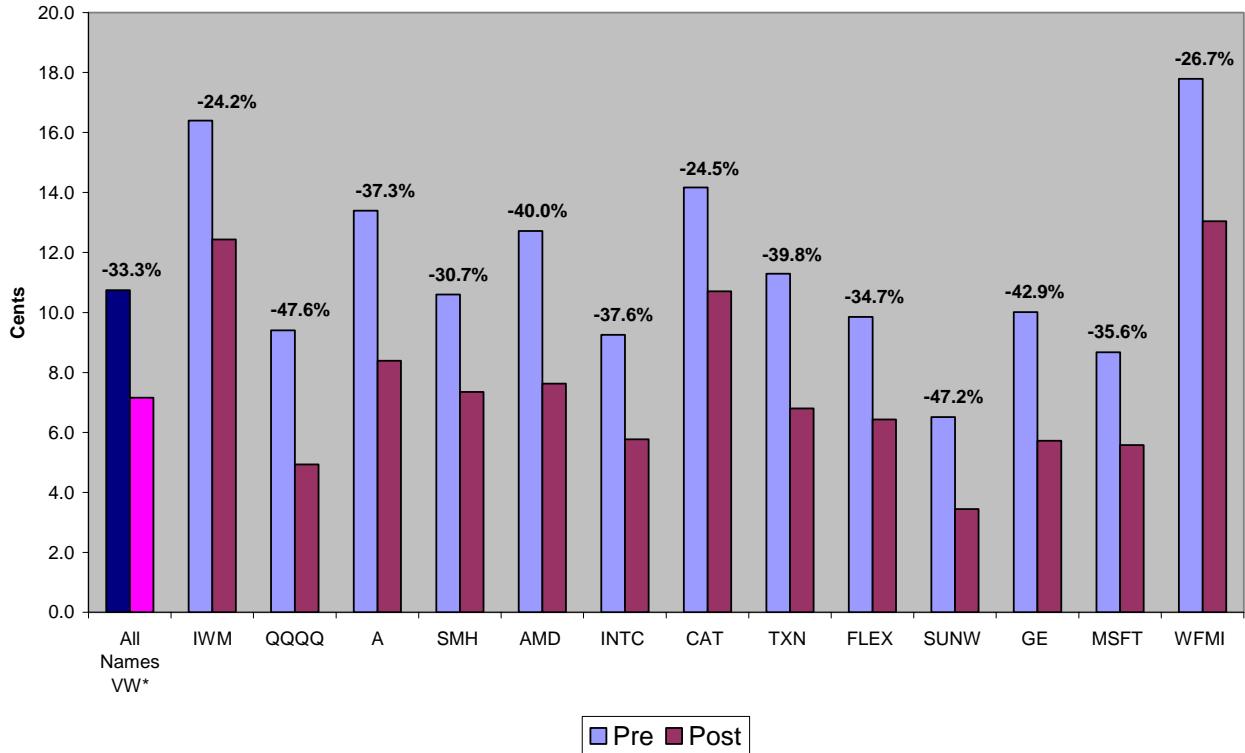


There was a significant reduction in the average spread of the pilot options. The Volume Weighted Spread¹ shows that for all pilot names there was a 33% decrease in spread from the time period prior to launch to the time period post launch. However, this reduction was quite varied between options.

¹ The Volume Weighted Spread takes the volume of each option pre- and post-pilot into account, giving proportional weight to each spread based on the option's volume. Please see Appendix A for an example of the calculation.

The following graph shows the reduction was in the range of 24.2% (IWM) to 47.6% (QQQQ). There is no correlation between the decrease in spread and the average daily volume ("ADV") in each option.

ISE Spread / Symbol Pre vs. Post Pennies



The following table examines how the BBO improved at different price levels within various options. The reduction in spread was more pronounced in QQQQ where it is quoted in pennies at all increments. For other options the reduction is not as great above \$3.00.

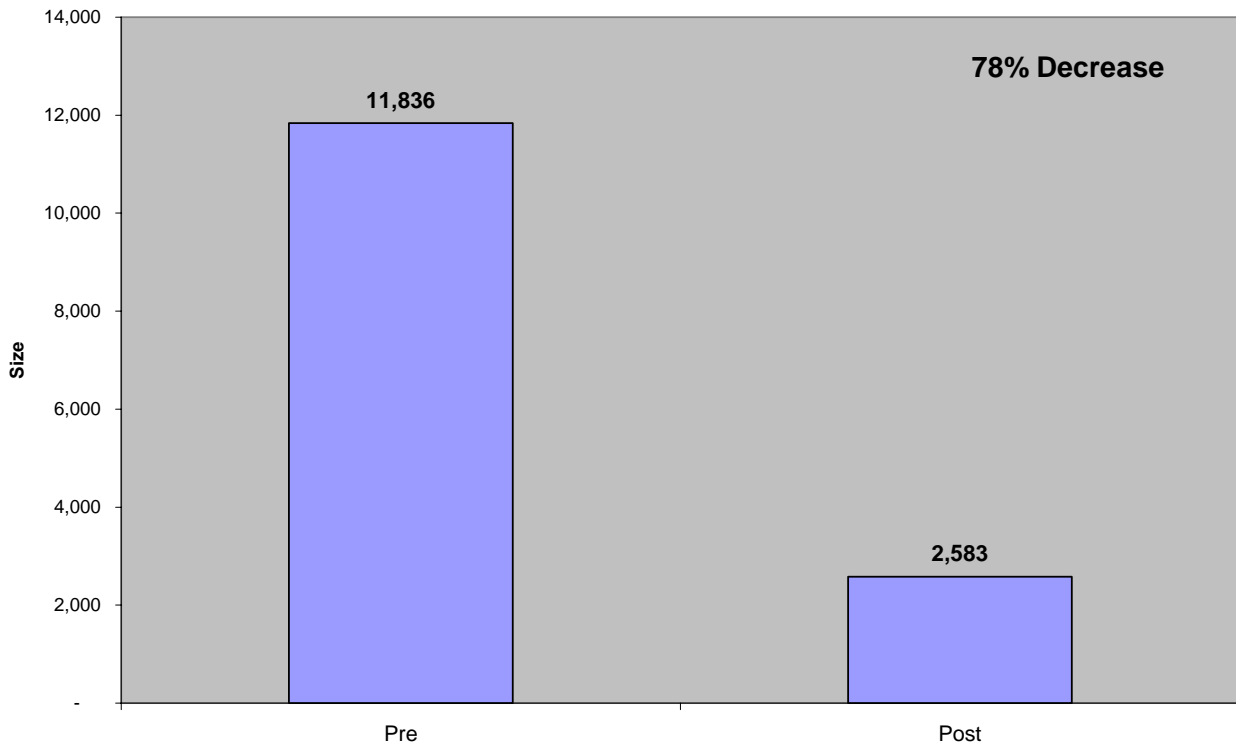
	Total	\$0.00-\$1.00	\$1.01-\$3.00	\$3.01-\$5.00	\$5.01-\$10.00	\$10.01-\$20.00	\$20.01->\$20.00
QQQQ	-56%	-61%	-52%	-61%	-56%	-53%	-32%
IWM	-26%	-50%	-46%	-32%	-24%	-16%	-7%
A	-43%	-59%	-47%	-35%	-33%	56%	-
SMH	-34%	-57%	-42%	-29%	-23%	-15%	-
AMD	-44%	-55%	-55%	-32%	-27%	-32%	-27%
INTC	-44%	-60%	-55%	-39%	-35%	-30%	-27%
CAT	-29%	-56%	-48%	-33%	-27%	-18%	-5%
TXN	-44%	-59%	-56%	-39%	-39%	-36%	-36%
FLEX	-41%	-56%	-44%	-31%	-29%	-21%	-
SUNW	-57%	-63%	-61%	-43%	-46%	-	-
GE	-48%	-62%	-57%	-42%	-42%	-41%	-
MSFT	-42%	-63%	-53%	-35%	-34%	-34%	-32%
WFMI	-30%	-59%	-53%	-42%	-36%	-20%	-3%

2.2. Size at the BBO

Size is another aspect of market quality. Size is the volume of contracts available at the BBO for each option series as published to OPRA.

The following graph shows the change in the ISE average size of the 13 pilot options in the three month period prior to the pilot start (Oct 25th 2006 – Jan 25th 2007) vs. the first three months of the pilot (Feb 9th 2007 – May 9th 2007).

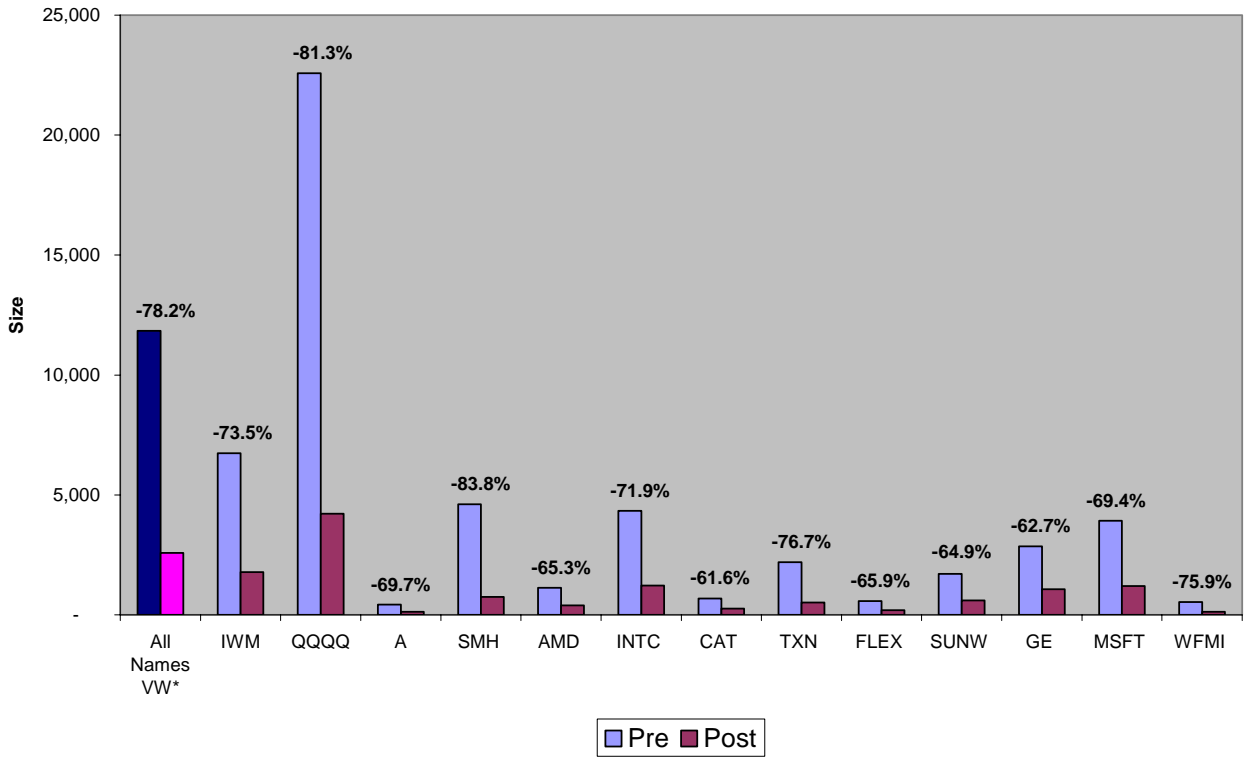
ISE Size Pre vs. Post: All Names (Volume Weighted)



The BBO volume-weighted size has been reduced by 78% in the pilot names. This raises significant concerns as the options exchanges strive to provide enhanced liquidity to attract institutional order flow.

Once again, there was quite a variation between the options. The following graph shows the before and after ISE sizes for each option in the Pilot. SMH and the QQQQ's size fell most drastically, each decreasing by greater than 80%. There is no correlation between the decrease in size and the average daily volume ("ADV") in each option.

ISE Size / Symbol Pre vs. Post Pennies



The reduction in quoted size was more pronounced in the QQQQs as it is quoted in one cent increments across all price ranges. The following table shows that the size did not change as much in options that continued to trade in five-cent increments above \$3.00.

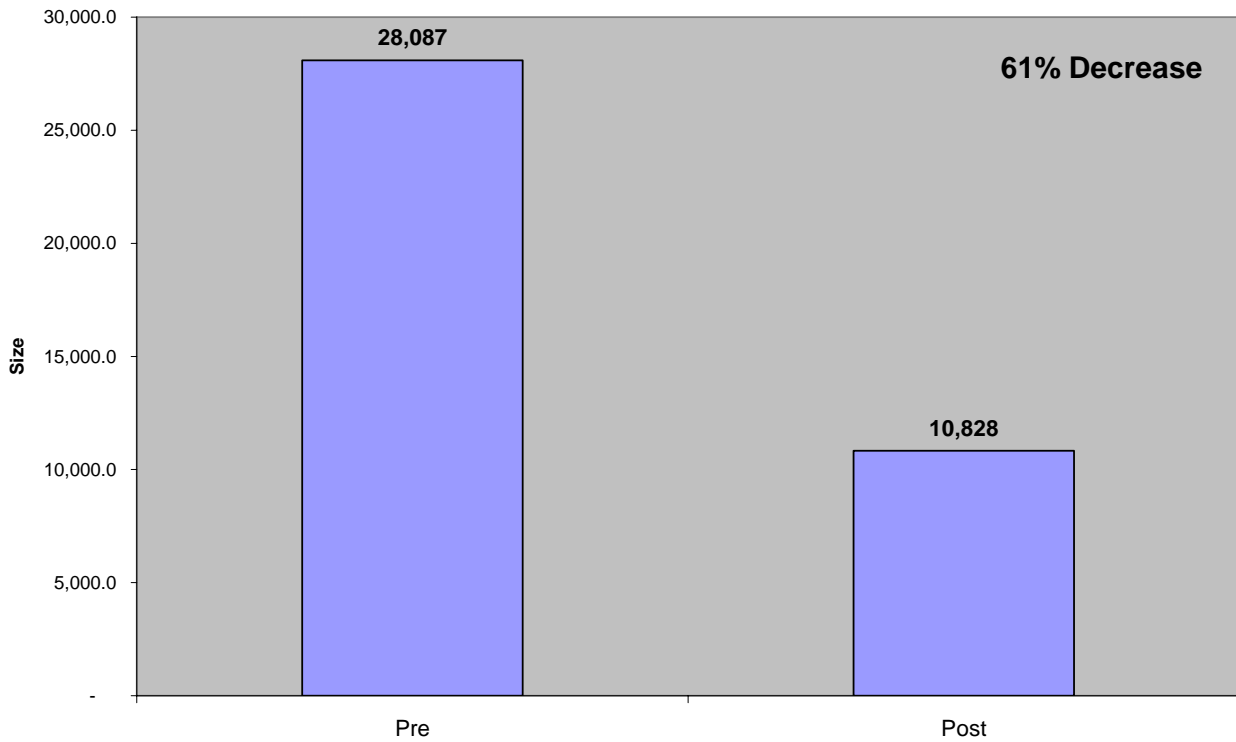
Size	Total	\$0.00- \$1.00	\$1.01- \$3.00	\$3.01- \$5.00	\$5.01- \$10.00	\$10.01- \$20.00	\$20.01- >\$20.00
QQQQ	-83%	-68%	-66%	-72%	-70%	-69%	-60%
IWM	-74%	-84%	-77%	-58%	-58%	-61%	-66%
A	-72%	-82%	-82%	-52%	-34%	110%	-
SMH	-84%	-90%	-88%	-67%	-57%	-39%	-
AMD	-66%	-75%	-76%	-48%	-47%	-29%	-16%
INTC	-72%	-82%	-83%	-37%	-19%	-18%	-24%
CAT	-62%	-80%	-73%	-23%	-30%	-10%	-2%
TXN	-77%	-85%	-87%	-54%	-50%	-33%	-41%
FLEX	-67%	-77%	-80%	-39%	-25%	-49%	-
SUNW	-67%	-70%	-75%	-14%	-5%	-	-
GE	-63%	-70%	-78%	-34%	-26%	-26%	-
MSFT	-70%	-81%	-82%	-52%	-26%	-11%	-17%
WFMI	-76%	-86%	-83%	-66%	-69%	-52%	-27%

2.3. Depth of Book

Another aspect of market quality is the total size of all quotes in the book at all price levels. This measurement is referred to as the Depth of Book.

The following table shows that ISE average depth, weighted for volume, for all 13 names in the penny Pilot was reduced by 61%. The combined liquidity available at all price levels is significantly less than what was available during the pre-pilot period. The smaller size at the BBO is not concealing larger liquidity at prices beyond the best bid and offer. That liquidity is no longer there.

ISE Depth Pre vs. Post: All Names (Volume Weighted)



Chapter 3. Capacity

This chapter considers the effect of the Penny Pilot on systems capacity.

We considered two aspects of capacity:

Quotes from Market Makers. Each exchange must process market maker quotes. An increase in the number of quotes received from the market makers is related to the cost of equipment needed by the exchange to operate the market. Quoting in pennies up to \$3.00 has almost doubled the number of quotes, meaning that both the exchange and its Market Makers will need to increase processing capacity at considerable cost.

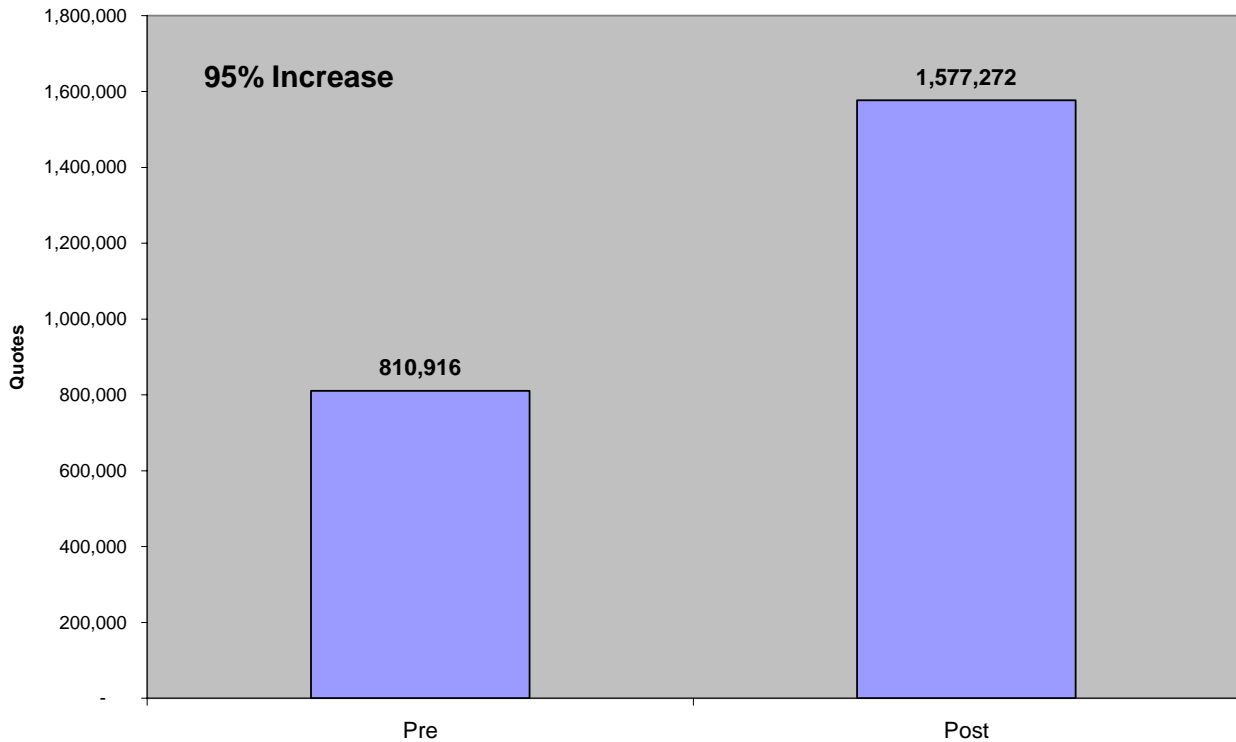
Quotes sent to OPRA. Each exchange must process and send quotations to OPRA. Quotes from market makers that affect the top of the book result in the exchange sending an updated quote to OPRA. An increase in the number of quotes sent to OPRA is related to the cost of equipment needed by all industry participants. Quoting in pennies up to \$3.00 has increased the number of quotes we send to OPRA by 25%, meaning that all industry participants will need to increase capacity to process these quotes. ISE implemented a Quote Mitigation process that effectively reduced the peak loads being sent to OPRA, thereby minimizing the expense to industry participants that process the OPRA data.

3.1. Quotes from Market Makers

Market makers are continuously updating their quotes based on their theoretical pricing models. Market maker quotes represent more than 99% of all traffic processed by the exchange, and the cost of the equipment needed to operate the exchange is directly linked to the number of quotes sent by the market makers. Moreover, market makers must bear similar – and substantial – costs to upgrade their own systems.

On average, the number of ISE quotes sent by market makers in the penny options other than QQQQ, increased by 95% as shown by the graph below.

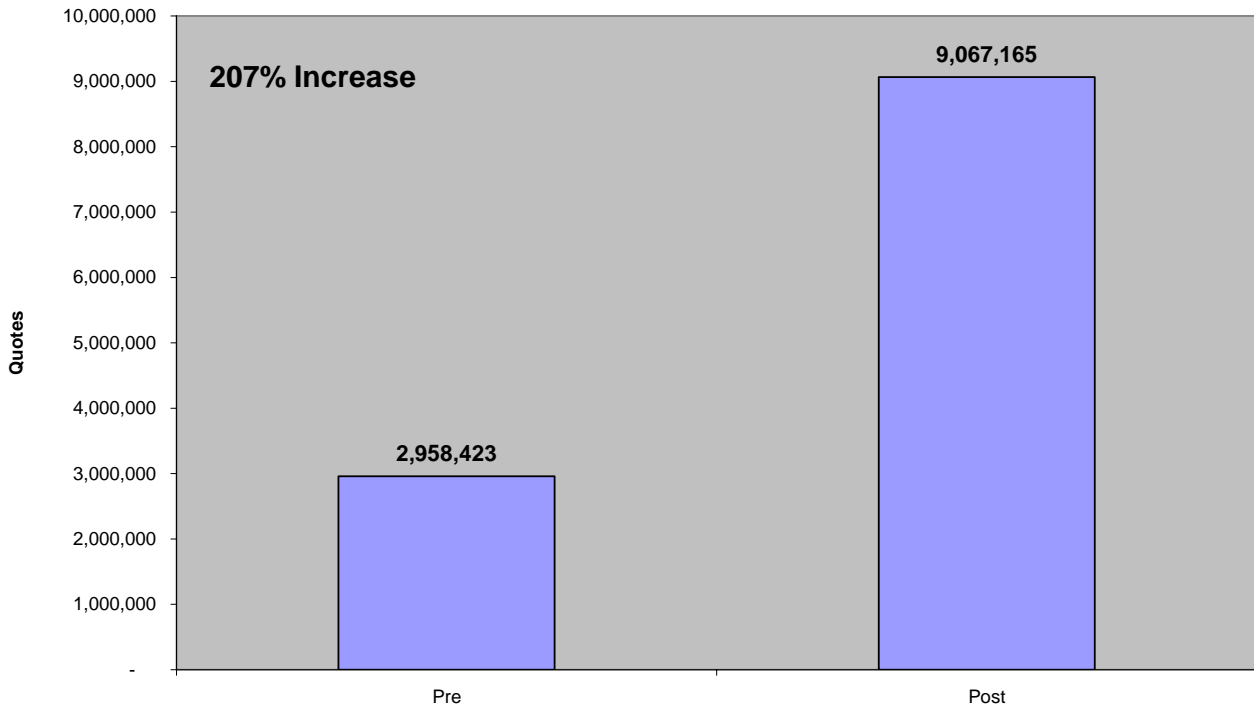
ISE Quotes from MM in 1c / 5c Names (Names other than QQQQs)



The increase in capacity required for ISE to process these additional quotes would be costly. Quoting increases of this size for all names would require the exchange to double its current capacity.

However, looking at the QQQs, which are quoting and trading in pennies at all price levels, there has been a much more pronounced increase in the number of quotes received by the exchange. The number of quotes received by the ISE for options in the QQQs has increased by 207% since penny launch.

ISE Quotes from MM in QQQQ



Quoting increases of this size for all names would require the exchange to triple its current capacity at considerable costs that are not justified, given the limited volume that is executed above \$3.00 (see section 3.2.1).

Furthermore, although QQQs have high traded volume, it does not produce as many quotes as some index and ETF products. In terms of quoting activity, prior to the Penny Pilot, the QQQs represented about 0.5% of all quotes sent to OPRA. In contrast, Google ("GOOG") represents 2.6% of all quotes sent to OPRA. We are concerned that quoting in pennies at all price levels in all options will seriously tax the various systems that must process these quotes.

Therefore, quoting in pennies at all price levels, because of capacity constraints, is very problematic at this time. While quoting at price levels up to \$3.00 is manageable, that too will require a significant upgrade to capacity and a controlled implementation.

3.1.1. Quoting in Pennies above \$3.00

The QQQQs are traded in pennies at all prices while the other Pilot symbols trade in 5c increments above \$3.00. The following table shows trades and quotes distributed above and below \$3.00.

As shown below, the volume that traded above \$3.00 is vastly smaller than that which traded below \$3.00. Specifically in the QQQQs, only 2% of the volume is over \$3.00 while 65% of the quotes are in options over \$3.00.

ISE believes that the large number of quotes needed to quote in penny increments above \$3.00 is not justified.

Post Penny 2/9/07- 5/9/07	% Volume Under \$3.00	% Volume Over \$3.00	% Quotes Under \$3.00	% Quotes Over \$3.00
QQQQ	98%	2%	35%	65%
IWM	92%	8%	48%	52%
A	93%	7%	66%	34%
SMH	96%	4%	59%	41%
AMD	97%	3%	67%	33%
INTC	93%	7%	66%	34%
CAT	78%	22%	42%	58%
TXN	92%	8%	53%	47%
FLEX	98%	2%	66%	34%
SUNW	100%	0%	87%	13%
GE	92%	8%	57%	43%
MSFT	90%	10%	48%	52%
WFMI	87%	13%	48%	52%
Average	92.75%	7.25%	57.08%	42.92%

Symbols other than QQQQ appear to have a higher proportion of trades over \$3.00. However, much of this could be due to very large Ex-Dividend strategies (CAT) and Short Interest Put Strategies (INTC and WFMI). We believe that the percentage of customer executions above \$3.00 is generally in the range of 2% and that the overhead of quoting in pennies above \$3.00 would not be justified for any option class.

3.2. Quotes to OPRA/Quote Mitigation

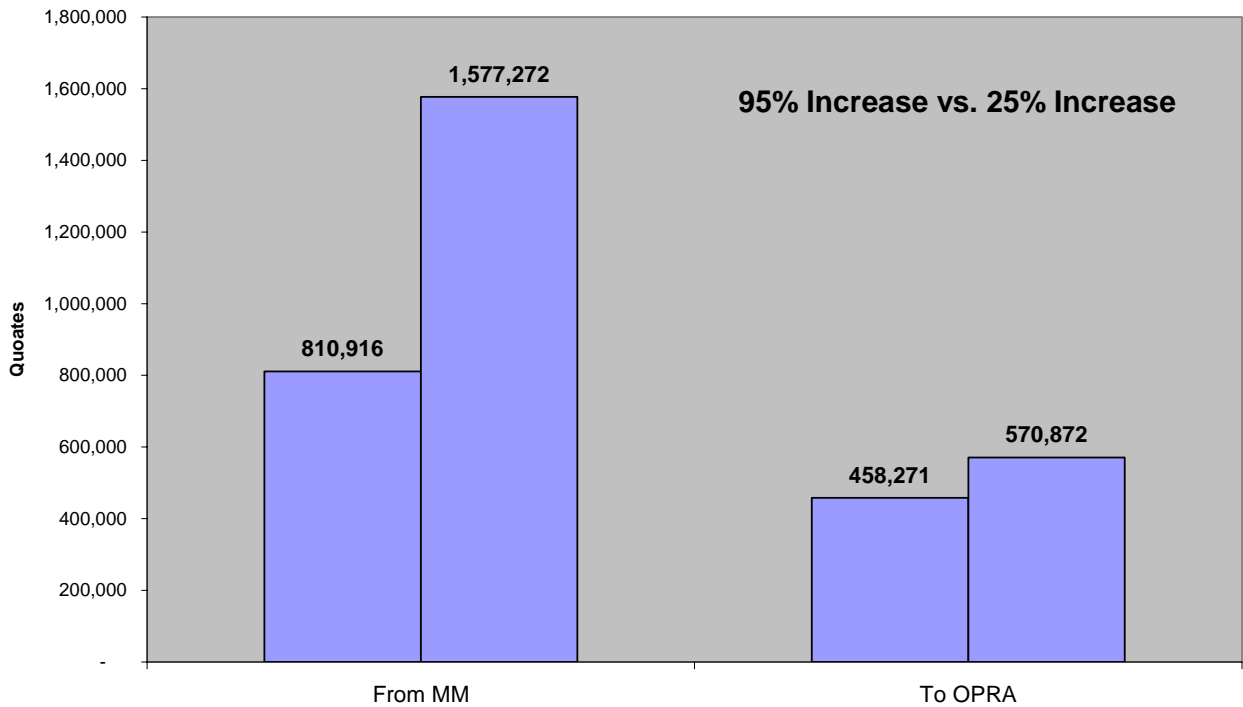
The Exchange receives quotes from market makers and orders from all market participants. If a market maker quote or an order changes our BBO, we send a new quote to OPRA.

As the number of quotes disseminated by OPRA increases, all industry participants must increase their systems' capacity to process and disseminate the additional quotes.

The number of quotes ISE sends to OPRA has increased by 25% in those options that quote in pennies up to \$3.00. This increase affects a plethora of industry participants, such as data vendors, brokers and online trading systems.

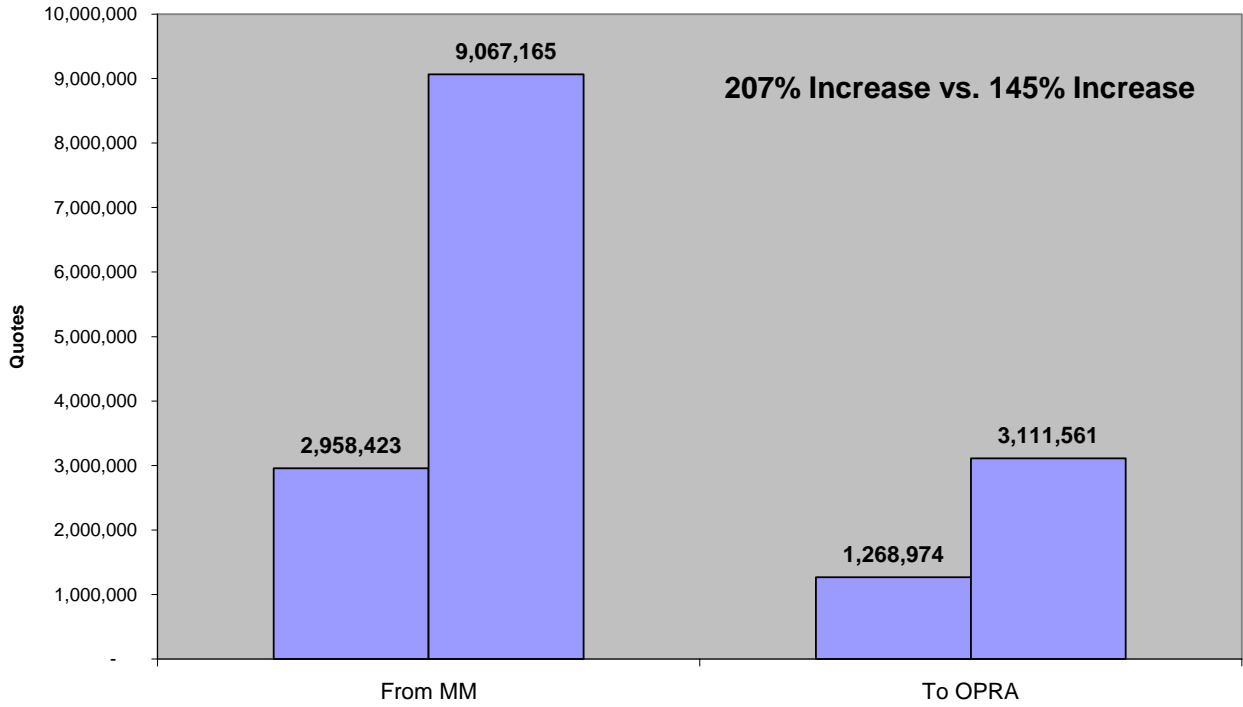
ISE has implemented a quote mitigation program that has limited the market maker quotes flowing through to OPRA. In options quoting in pennies up to \$3.00, the number of quotes from market makers increased by 95% whereas the number of quotes going to OPRA has increased by only 25%.

ISE Quotes from MM vs. Quotes to OPRA (Names other than QQQs)



We have observed a similar effect in QQQQ, which trades in pennies at all prices. The number of quotes from market makers increased by 207% whereas the number of quotes we send to OPRA increased by 145%.

ISE Quotes from MM vs. Quotes to OPRA in QQQQs



3.2.2. Quote Mitigation

ISE has up to 20 market makers in some instruments, and occasionally we have many market makers updating the same instrument at the same time. This can cause peaks in the traffic sent to OPRA.

ISE has a "Holdback Timer" mechanism that holds the updates by up to one second so that the exchange does not generate separate updates as each market maker moves its quotes.

Regardless of the number of quotes received from market makers, the ISE Holdback Timer limits the number of updates that are sent to OPRA. For example, ISE might receive up to 14 market maker updates in one option in one second, but will send less than eight to OPRA.

The effectiveness of the Holdback Timer can be measured by looking at the updates in one of the most active options series. We analyzed the QQQQ April 45 Call, an active option series. During the trading day of 04/17/07, between 10:00 a.m. and 4:00 p.m., the at-the-money QQQQ April 45 Call received 12,074 orderbook changes, which are mainly from market maker quotes. This is close to one quote every two seconds. There were individual seconds when up to 14 order book changes occurred.

After applying the Holdback Timer, ISE sent to OPRA only 9,604 updates, and the most it ever sent in any one second was seven updates. The Holdback Timer has the effect of removing about 30% of all quotes and reducing the peak by 50%

The following table compares this series with other options exchanges over the same interval. ISE sent the least amount of quotes to OPRA within a peak second.

QQQQ April 45 Call 04/17/07	ISE	Amex	Box	CBOE	Arca	PHLX
Quotes to OPRA	9,604	6,000	9,960	20,317	6,584	9,313
Max in one sec	7	9	12	22	12	9

We believe that ISE's Holdback Timer system has been a successful quote mitigation strategy in the pilot names. The below chart shows that prior to the penny launch ISE had a quote mitigation rate of 47% in the pilot names, whereas since the penny launch the quote mitigation rate has increased to 64%.

In absolute terms, during the three month pilot, ISE received on average, twenty eight million quotes per day from pilot names, while it disseminated fewer than ten million quotes per day.

	Pilot Names: Average Quotes From MM	Pilot Names: Average Quotes To OPRA	% Quote Mitigation
Pre: 10/25/07 – 01/25/07	12,689,418	6,768,221	47%
Post: 02/09/07– 05/09/07	27,994,430	9,962,020	64%
% Change	121%	47%	

Chapter 4. Trading Activity

4.1. Average Daily Volume (ADV)

The following table shows national turnover and compares penny options against non-penny options for time periods before and after the launch. The penny Pilot options ADV increased by 33%, while the non-penny options only increased by 9%. However, it is difficult to state that this increase is directly related to pennies as there have been a number of market events that affected turnover in recent months.

	Industry Equity Without Penny ADV	Industry Penny ADV
Pre: 10/25/07 – 01/25/07	7,881,208	1,193,603
Post: 02/09/07–05/09/07	8,607,323	1,587,600
% Change	9%	33%

While the increase in overall trading volume is high, there was significant variation between the options. The greater increases were confined to the high liquidity options. Other symbols show no substantial increase in volume during the Pilot.

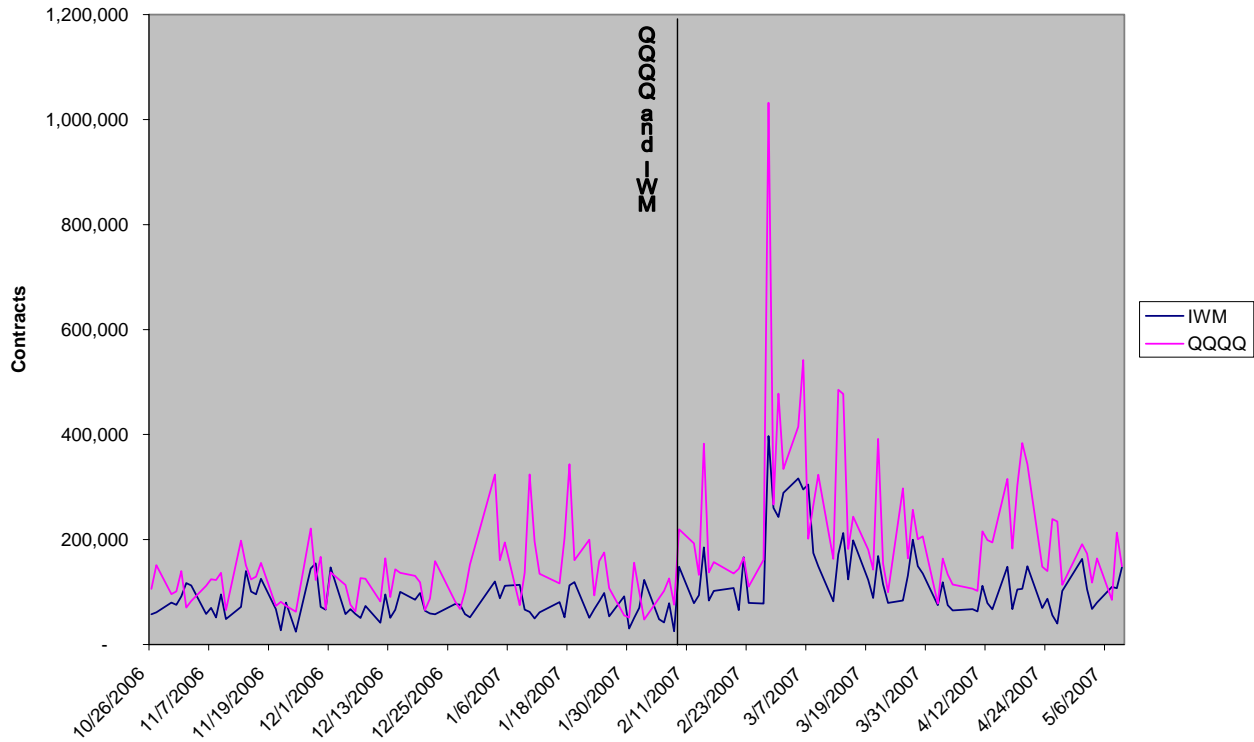
We are not sure whether to attribute the increased activity in the high volume options to market conditions, or the introduction of pennies. SPY options, which are not part of the Pilot had a significant volume increase as shown below, comparable to that of QQQQ and IWM.

Penny Pilot ADV			
Option	Pre	Post	Change
QQQQ	133,163	233,338	75%
IWM	80,017	132,998	66%
INTC	31,404	29,053	-7%
MSFT	30,092	27,986	-7%
AMD	18,892	14,622	-23%
GE	14,925	18,430	23.5%
CAT	10,592	8,675	-18%
TXN	11,021	11,501	4%
SMH	9,940	13,743	38%
WFMI	6,377	6,682	5%
SUNW	5,290	2,970	-44%
A	1,375	1,649	20%
FLEX	1,125	626	-44%

Non-Penny Pilot ADV			
Option	Prior	Post	Change
SPY	246,449	381,909	55%

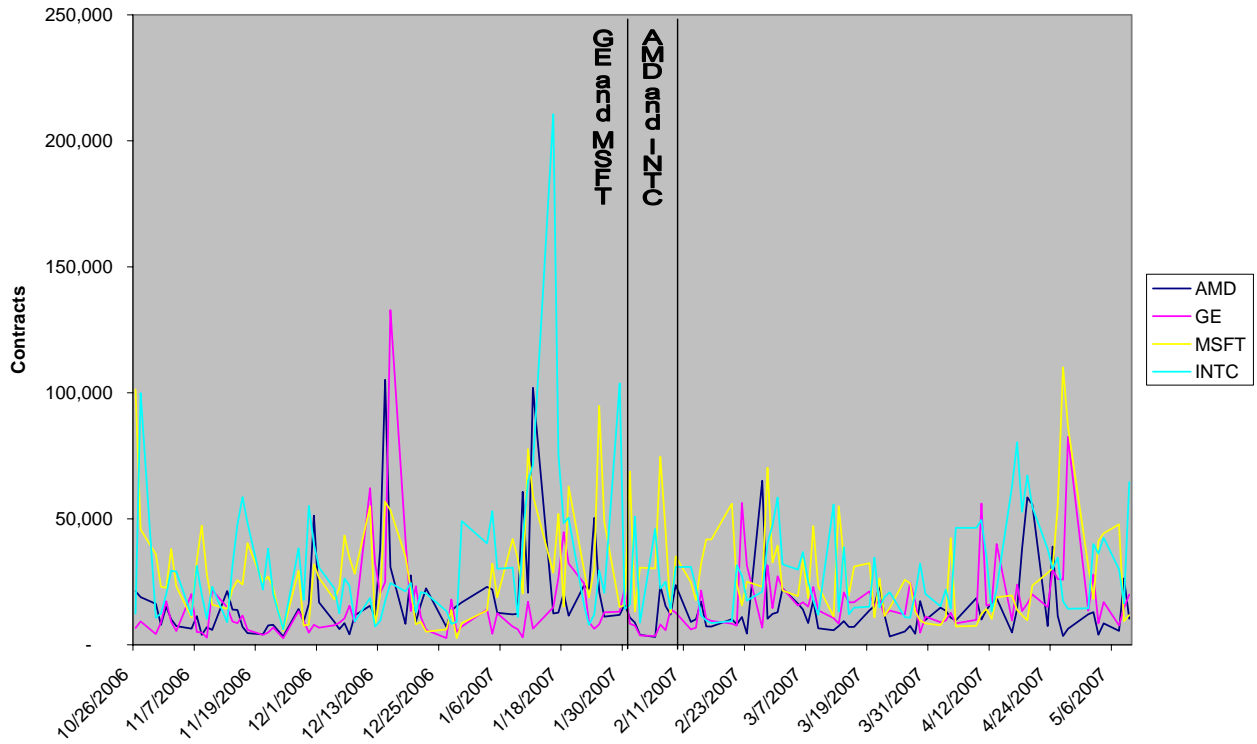
Following the implementation of pennies, the high volume options had spiked on ISE, as shown below. The vertical line shows the date on which these symbols were converted to pennies. Although still higher than pre-Pilot levels, the volume decreased in the latter part of the Pilot.

High Volume Names Pre vs. Post Pennies (ISE Volume)



As shown in the graph below, medium volume options have not shown any substantial change in turnover with the introduction of pennies.

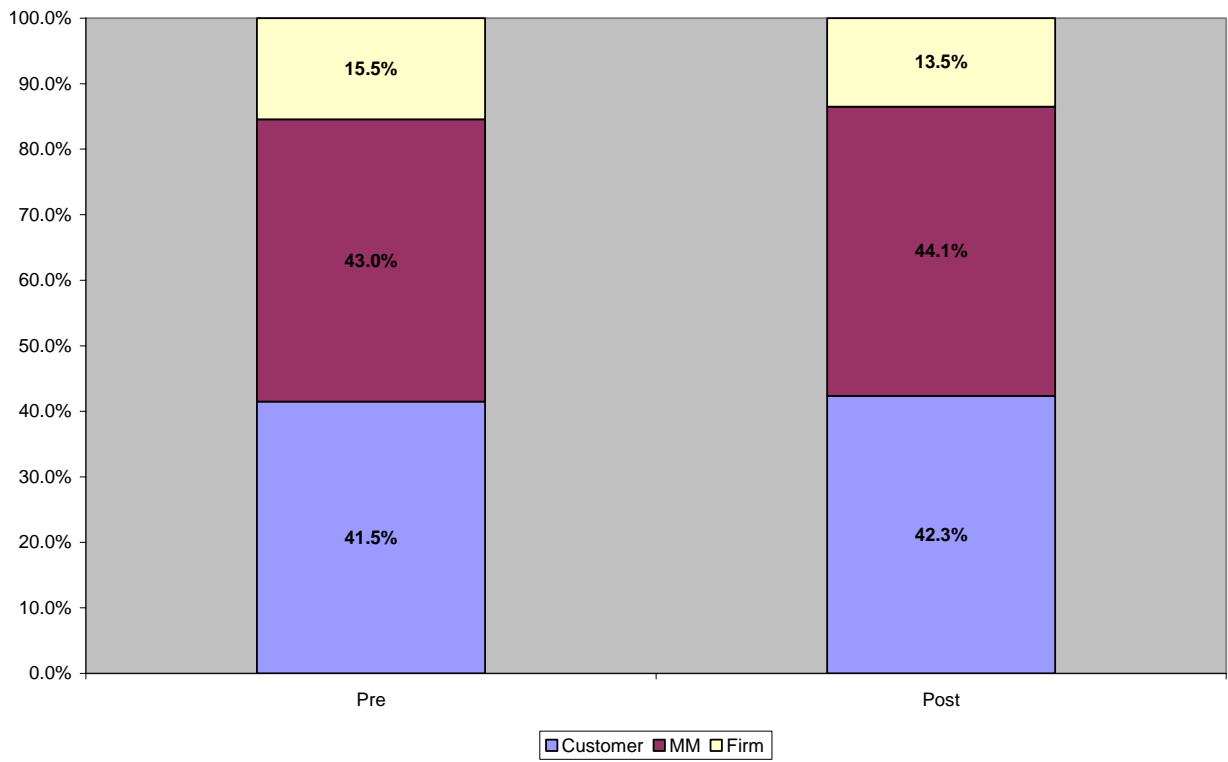
Medium Volume Names Pre vs. Post Pennies (ISE Volume)



4.2. CFM analysis

The following graph shows that proportion of trades marked Customer, Firm and Market Maker on ISE has not changed significantly.

% ISE Customer, MM, and Firm Pre vs. Post Pennies



Chapter 5. Linkage

This chapter looks at issues relating to the Inter-Market Linkage system ("Linkage"). In general there were no issues observed.

5.1. Linkage Orders

There were no issues observed with Linkage Orders; however, we are only processing 5% of the market. There are general concerns that the linkage hub does not have sufficient capacity and that a full penny conversion may place too great a strain on the linkage system.

5.2. Linkage Timeouts

Linkage "timeouts" occur when ISE sends a Linkage order to an away exchange and the away exchange does not respond for five seconds as required by the Linkage plan. The average number of orders that timed out, per day, for the penny options has increased minimally from 1.3 to 1.6 orders per day.

5.3. Satisfaction Orders

We send Linkage Satisfaction Orders when an away exchange trades through a customer order on the ISE. The number of Satisfaction Orders sent, per penny option, per day has increased minimally from 0.5 to 0.8. Given the low number of Satisfaction Orders generally, we do not consider this significant.

Chapter 6. Conclusions and Recommendations

6.1. Conclusions

- Market Quality – At least with respect to spreads, the quality of the market improved with the introduction of pennies. Spreads reduced significantly. While there is still sufficient size on the book for an average sized retail order, the reduction in liquidity will impact institutional traders.
- Capacity – The number of quotes produced by market makers increased substantially, as expected. The number of quotes sent to OPRA increased, but to a lesser extent. Any expansion of penny quoting and trading will require additional quote-processing capacity.
- Trading Activity – The ADV increased in high volume options; however equivalent non-penny options had similar increases. The turnover in medium and lower volume options did not change significantly.
- Linkage – There have not been any issues with Linkage in the penny options, although there is a concern that full implementation of pennies will exceed the capacity of the options Linkage system.

6.2. Capacity Plan

The increase in quotes from market makers has a direct impact on the cost of exchange equipment. To process quotes in pennies up to \$3.00 for all options will require that that quoting capacity be doubled. ISE does not have sufficient capacity in existing systems to process pennies, and will need at least six months to build out that capacity and test it with participants. The cost of the equipment will be considerable.

The increase in OPRA traffic is not as great as the increase in market maker quotes. However, it is directly related to the cost of equipment needed by all industry participants. The Pilot indicates that to process quotes in pennies in all options up to \$3.00 will require that the industry increase its capacity for market data by 25%. This is a considerable project because of the high number of industry participants it affects, a reasonable timeframe of at least six months will be required.

To process quotes in pennies at all price levels would require that ISE quoting capacity be tripled. Such an increase will be extremely costly to ISE and its members and will take at least 18 months to implement. This would be an unreasonable burden given that in penny names, on average, less than 7% of executed volume was done over \$3.00. In particular, only 2% of the QQQQs volume was done over \$3.00. Further, there is concern that the busiest options in terms of quotation load could not be processed by the ISE if they were to be quoted in pennies at all increments.

6.3. Expansion of the Pilot

ISE has the following recommendations with regard to the Penny Pilot:

1. The Exchange's analysis is limited to effects we could observe directly. This analysis leads to our concern that penny quoting could have significant adverse effects on market makers and institutional investors. Therefore, the Commission should conduct a thorough analysis of the effect of the Penny Pilot on these market participants before considering any expansion of the Pilot.
2. Should the Commission eventually decide to expand the Pilot, then penny quoting should be confined to a limited range of options where there is: high liquidity in the underlying security; low volatility; low underlying value; and high retail customer appeal. High priced, high volatility symbols (such as GOOG) should be avoided, as penny quoting in such names will dramatically increase quotation traffic with no real benefits for investors. An industry forum such as SIFMA should co-ordinate the selection of these symbols.
3. ISE will require six months notice before any expansion to upgrade its system capacity. We believe it may take other market participants even longer to upgrade their systems.
4. In any rollout, the largest options by volume of quotes should be left to the end of the rollout period.
5. Quoting in pennies should be limited to prices below \$3.00. QQQQ should be altered to quote in nickels above \$3.00. Barely 2% of the trades in QQQQ were above \$3.00 while 65% of all quotes in QQQQ were above \$3.00. We believe this ratio would apply to customer orders in other symbols as well, and that the additional cost of quoting in pennies above \$3.00 is not justified.

Appendix A: Volume Weighted Spread

Calculation

The Volume Weighted Spread, Size and Depth are calculated by adding proportional weight to each underlying based on volume executed in that underlying when averaging factors.

The Volume Weighted Spread uses the following formula

$$\frac{\sum_n^i Spread_i * Volume_i}{TotalVolume}$$

If the spreads and adjacent volume were as follows:

Spread	.26	.38	.26	.23
Volume	98	3,222	3	56

Then, the Volume Weighted Spread would be calculated as below:

$$\frac{(.26 * 98) + (.38 * 3,222) + (.26 * 3) + (.23 * 56)}{3,379}$$

$$\frac{(25.48) + (1,224.36) + (.78) + (12.88)}{3,379}$$

$$.3739$$

The Volume Weighted Size and Volume Weighted Depth are calculated in similar fashions.



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