OTC Trading: Description of Non-ATS OTC Trading in National Market System Stocks

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This paper is the second in a series of white papers that investigate off-exchange trading of National Market System (NMS) stocks. This paper's focus is limited to over-the-counter trading of NMS stocks that occurs without the involvement of Alternative Trading Systems (ATSs).[2]

I. Introduction

This paper provides general information on non-ATS over-the-counter (OTC) trading of NMS stocks. Press articles and academic research dealing with OTC trading tend to focus on ATSs rather than the larger share of off-exchange trading that occurs outside of ATSs. In addition, when non-ATS OTC trading is described, it is often assumed to consist primarily of internalized retail order flow.[3] This may be a consequence of the lack of public data describing non-ATS OTC trading, particularly the trading that is not directly related to retail trading. The purpose of this paper is to provide basic descriptive statistics on this segment of the equity markets and to serve as a resource to Staff of the Commission and commenters.

Summary of Main Findings:

[1] This memorandum was prepared for Craig Lewis, Director and Chief Economist of the Division of Economic and Risk Analysis (DERA). It was reviewed by Amy Edwards and Jennifer Marietta-Westberg, DERA, and Michael Gaw and Dan Gray, Division of Trading and Markets (TM). Michael Gaw and Dan Gray provided substantial assistance with knowledge of institutional detail and SEC rules that govern OTC trading and required disclosures. The U.S. Securities and Exchange Commission, as a matter of policy, disclaims responsibility for any private publication or statement of any of its employees. The views expressed herein are those of the author and do not necessarily reflect the views of the Commission or of the author's colleagues upon the staff of the Commission.

[2] See *Alternative Trading Systems: Description of ATS Trading in National Market System Stocks* for a discussion of NMS trading on ATSs.

[3] Internalized orders are executed by market participants rather than routed elsewhere to find a counterparty. Preferenced order flow is directed to another market participant for execution off-exchange. Often, the receiving firm pays the routing firm to send the order flow for execution. Press articles sometimes discuss these OTC orders outside of ATSs but do not always distinguish the categories, or even recognize that ATS trading comprises a minority of OTC trading. See for example http://blogs.wsj.com/moneybeat/2013/08/23/bats-and-direct-edge-would-shake-up-exchange-volumes/, http://www.economist.com/node/21526387 and http://www.nytimes.com/2013/04/01/business/as-market-heats-up-trading-slips-into-shadows.html?pagewanted=all&r=0.

- I estimate that 16.99% of total dollar volume (18.75% of share volume) of NMS stocks is executed OTC without the involvement of an ATS. The subsample of Retail OTC Market Makers (OTC MMs)[4] executes 37.23% of this dollar volume (39.93% of share volume).
- The non-ATS OTC segment of the market is larger than the ATS segment that I estimate to comprise 11.31% of total dollar volume (12.04% of share volume).
- The average non-ATS OTC order is for 1,451 shares; the average order for Retail Over-the-Counter Market Makers (OTC MMs) is smaller at 882 shares. The average aggregate fill size for non-ATS OTC orders is 368 shares, and is nearly identical in size for Retail OTC MMs and other participants.
- The trade size distribution for non-ATS trades is dissimilar to the distribution of trade sizes on ATSs and exchanges. Trades of greater than 1,000 shares are more common among non-ATS trades.
- 255 broker-dealers report non-ATS OTC trading activity during my sample week.
- The three participants with the highest market share collectively execute 32.34% of non-ATS OTC trading dollar volume (35.00% of share volume). I classify all three participants as Retail OTC MMs.
- The twenty largest participants execute 84.95% of non-ATS OTC dollar trading volume (84.81% of share volume).
- Using the traditional block size of 10,000 shares, block trades comprise only 0.10% of dark[5] ATS trades, while they comprise 2.53% of non-ATS OTC trades. While this seems to suggest a stronger block-market role for the non-ATS OTC market, I believe that some and perhaps much of this block volume represents aggregate trades from broker-dealers to their customers. In such a trade, a broker-dealer acquires a position through numerous small trades across multiple venues, then reports one or more large trades with its client. Consequently I interpret this measure with caution.

II. Description of Data, Data Limitations and Methodology

This study presents a set of descriptive metrics chosen to provide basic summary information on off-exchange trading. The statistics presented in this paper include the following:

1) *Aggregate OTC trading levels*: These statistics describe the proportion of NMS trading accomplished without the involvement of an exchange, and within the off-exchange category, without the involvement of an ATS.

[4] Although my results differentiate certain broker-dealers (referred to as Retail OTC Market Makers) that I identify as recipients of significant retail order flow, some or all of these firms also provide significant broker-dealer services to institutional clients. My methodology for identifying Retail OTC MMs is described in Appendix A.
[5] I consider as "dark" any ATS that does not provide top-of-book quotations to a public venue. Under this definition, all registered ATSs are dark with the exception of electronic communication networks (ECNs).

2) *Market share*. Market share statistics partially describe the level of competition within the market. They also describe the relative economic importance of different segments of the market.
3) *Order and trade sizes*. Order and trade sizes can provide information on how a venue is being used by traders, and possibly what type of participants use a venue.
4) *Percent trading as riskless principal*. Riskless principal trades have different reporting requirements and may carry different economic implications than agency or principal trades. I report the percentage of riskless principal trades to aid in interpreting other statistics.
5) *Cross-sectional characteristics*. I present statistics summarized for securities with different market capitalization and price characteristics. I also present statistics separately for exchange traded funds (ETFs). These characteristics are often linked to market quality measures. I present conditional results so that readers may judge the degree to which they influence aggregate statistics.

My data comprises all Financial Industry Regulatory Authority (FINRA) Order Audit Trail System (OATS)-reported orders and trades for NMS stocks for the five-day period covering May 7-11, 2012. OATS includes execution reports for nearly all OTC trading by FINRA member firms.[6]

My results are based on a sample of 6,684 securities.[7] I analyze 19.2 million orders resulting in 34.9 million fills representing $383.3 billion in trading.[8] My data permit me to examine order and trade characteristics and market share at a point in time, but do not allow me to examine changes in these metrics over time as NMS market structure evolves in response to industry and regulatory changes.

Methodological Details

This section describes the methodology I apply in this study. It also discusses data limitations, and limitations resulting from my choice of methodology.

In several tables, I present results for a subsample of broker-dealers I refer to as Retail OTC MMs. My intent in creating this subsample is to segregate what is traditionally thought of as preferenced retail order flow. While this allows me to describe potential OTC retail order flow, my goal is to better

[6] Some FINRA members are exempt from OATS reporting requirements for manual orders if they meet several conditions relating to their size, lack of proprietary trading and absence of customer accounts. In addition, OATS reporting requirements do not apply to certain transactions related to a registered market maker's normal market making activities. I am unable to estimate the proportion of OTC trading this excludes from analyses in this study.
[7] I construct my sample in the following manner: I begin with 6,686 NMS stocks for which I have Center for Research in Security Prices (CRSP) volume, price and share class information for April 2012. I remove two securities of issuers that have corporate actions that affect security characteristics. My final sample is 6,684 stocks.
[8] My methodology excludes orders that generate no fills. In addition, many orders generate multiple fills. Methodological details are discussed in the following section. These numbers are not adjusted for double-counting of executed volume. Some, but not all, volume in non-ATS OTC markets is double-counted.

describe the residual, *other* OTC order flow.[9] By definition and by construction, the composition of the group of Retail OTC MMs is subjective. The identification of Retail OTC MMs is described in Appendix A.

I make several empirical decisions that influence aggregate OTC trading level and market share statistics. First, when I refer to market-wide volume, I refer to all sample stock volume reported to the New York Stock Exchange's Trade and Quote Database (TAQ) that excludes odd-lots. To the extent that odd-lots trade off-exchange differently than round lots, this may introduce a bias to results.[10] Second, by necessity I indirectly identify the aggregate proportion of volume executed OTC without the involvement of an ATS. I can identify the volume on ATSs with good precision because nearly all ATS order flow is double-counted within OATS: most ATS transactions create two execution reports.[11] This is not true of all OTC order flow because one side of the transaction may have no OATS reporting obligation.[12] Furthermore, transactions that involve a riskless-principal designation[13] are more common outside of ATSs.[14] I address these issues by measuring the size of the non-ATS OTC market as the

[9] While I believe the majority of retail order flow is included in the Retail OTC sample, some retail flow is routed to firms classified as "other". In addition, Retail OTC MMs have significant involvement in the institutional market as well. See Appendix A for details on my methodology for constructing these samples.

[10] To maintain comparability between volumes computed for OTC activity from OATS and market-wide volume statistics from TAQ, I exclude odd lots from the former in aggregate market-share calculations. For all other analyses in this study, odd-lots are included unless otherwise stated. For nearly all stocks, a trade for less than 100 shares is referred to as an "odd-lot". For a few securities with very high share prices, the "round lot" size is one share and thus these securities have no odd-lot trades. Odd-lots are not required to be reported to the consolidated tape at the time of my sample.

[11] There are exceptions. Some ATS transactions are exempt from OATS reporting obligations.

[12] When an execution occurs on an ATS, the ATS generally must report two execution records within OATS, resulting in double-counted execution volume. Outside of ATSs, volume may or may not be double counted because only Finra members have OATS reporting obligations. Many customers of broker-dealers are not Finra members and therefore would not report their side of the trade to OATS.

[13] Broker-dealers effect trades for customers acting in a principal, agency, or riskless principal capacity. The capacity in which a broker-dealer acts can affect how the volume of OATS execution reports relates to the volume of trades on the consolidated tape. Generally, a principal trade is one in which the BD trades for the firm's own account. In an agency trade, the transaction is conducted on behalf of a customer; the BD does not own the position at any point in time. A trade can generally be classified as riskless principal when the BD acquires the position for the firm's account with the intention of using it to fill (at the same price) a customer order it has already received. These three capacities can be similar economically but have different reporting requirements to OATS and the Consolidated Tape. For example, agency and principal trades generally require one execution report in OATS for each side, and one report to the consolidated tape per trade. The second leg of a riskless principal trade, however, would generally have an OATS execution report for each side but no associated consolidated tape report. In view of the different ways in which a client order can be executed and their differential impact on consolidated tape volume, I interpret volume figures cautiously. In addition, I provide detail regarding the percentage of volume being transacted as riskless principal to allow for interpretation by readers. See, FINRA Guidance (http://www.finra.org/Industry/Regulation/Guidance/p038942#302).

[14] When a transaction meets the definition for riskless principal designation under Finra's rules, the second leg is excluded from regulatory fee collection and consolidated tape reporting. Consequently, differential occurrence of riskless principal trades between groups may cause one segment of the market to appear larger.

residual of OTC volume and ATS reported volume, adjusting for ATS volume within OATS that I believe is not flagged as occurring on an ATS.[15,16]

Once I have measured the overall size of the non-ATS OTC market, I can describe market shares for subsets of this segment of the market in a relative fashion (as a percentage of all trading within a segment), including or excluding riskless-principal transactions as appropriate.[17] Generally, I report results both for the full sample of broker-dealers, and with the Retail OTC MMs partitioned. I include riskless-principal transactions in all measures unless otherwise noted, and describe the proportion of trading reported as riskless-principal where appropriate.[18]

Finally, an additional limitation to my study relates to the manner in which I identify OTC non-ATS orders. Orders are identified when they generate OTC executions that do not occur on an ATS. Consequently, I exclude orders that receive no fill by my methodology.[19] Collectively, these limitations

[15] See Alternative Trading Systems: Description of ATS Trading in National Market System Stocks . I believe that 11.3% of ATS trading is not explicitly identified as ATS trading within OATS. I construct this estimate using 2012Q2 Form ATS-R filings with the Commission. To describe the size of the non-ATS OTC market, I subtract this undesignated ATS volume from the residual of off-exchange volume and identified ATS volume. When I describe market shares within the off-exchange, non-ATS market, this undesignated ATS volume affects my results. None of the ATSs which are not represented within my ATS sample are operated by firms classified as Retail OTC MMs.

[16] My methodology is founded on two assumptions. First, I assume that all ATS volume is double counted in OATS execution reports. I also assume all ATS trades of round-lot or greater size are reported to the Consolidated Tape. I believe these assumptions to be reasonable, although I am aware that these assumptions have certain exceptions. Generally, one OATS execution report is generated for the buy order and a separate execution report is reported for the sell order. Further, all registered ATSs that trade in NMS stocks have OATS reporting obligations. However, not all ATS trades have Consolidated Tape reporting obligations. Although I believe the vast majority of ATS trades of round-lot or greater size require tape reporting, this assumption overestimates the fraction of consolidated tape volume that occurs on ATSs because of exceptions to tape reporting obligations primarily related to market making activities and riskless principal transactions. Although there may be a one-to-many relationship between buy and sell execution reports, the one-to-one relationship should hold on a volume basis. Finally, there are exceptions to the general rule that each ATS trade results in two execution reports within OATS, particularly when a counterparty's order resides in another market venue. I believe such exceptions to be infrequent.

[17] I do not exclude volume which is not media reportable, such as internal trades within a firm.

[18] To the extent that one subsample is more inclined to use riskless-principal transactions with other OATS reporting participants as counterparties, double-counting may bias results toward overstating the relative market share of that subsample.

[19] An alternative approach would be to identify all orders within OATS that are not within an ATS as non-ATS OTC orders. The problem with this approach is that it would include all routing between FINRA-member firms regardless of whether that routing could lead to a fill by the receiving member. OATS does not allow me to discern whether the receiving firm was a routing partner, or whether the receiving firm had the option of matching or filling the order in whole or in part before seeking a counterparty elsewhere. OATS also does not allow me to discern whether the routing firm is seeking a fill or further routing from the receiving firm. To the extent that an order implies intention on the sender's part to receive a fill directly from the receiver, I cannot ignore the possibility that routing participants may be unaware their orders are being partially filled OTC by the receiving firm before being routed to other venues.

preclude the measurement of fill rate statistics from the data in this study. Furthermore, they introduce an upward bias into measures of order sizes.[20]

III. Aggregate OTC Trading in NMS Stocks

In this section I estimate that 16.99% of dollar volume (18.75% of share volume) of NMS stocks is executed OTC without the involvement of an ATS.

In Table 1, I present an estimate of the size of the OTC non-ATS market measured in both share and dollar volume. During the week of my sample, the New York Stock Exchange's Trade and Quote database (TAQ) reports that the 6,684 NMS stocks in my sample had trading of 34.81 billion shares valued at approximately $1.15 trillion, with 28.31% of this dollar volume (30.79% of share volume) reported to a trade reporting facility (TRF).[21] I estimate OTC non-ATS volume by adjusting this TRF-reported volume for single-counted[22] ATS trading and excluding odd-lots that are not tape reported.[23] I further adjust for ATS volume that I believe to occur within ATSs but which cannot be distinguished from non-ATS trading within OATS.[24] After these adjustments, my estimate of non-ATS OTC consolidated tape-reported volume is $195.33 billion (6.53 billion shares), comprising 16.99% of tape-reported dollar volume (18.75% of share volume).[25]

[20] Assuming that larger orders are often partitioned into smaller orders and sent to venues over time, there is more time for large orders to receive partial OTC fills from participants working those orders, as opposed to smaller orders, that are generally filled quickly or routed elsewhere. This upward bias in order sizes does not extend to measures of fill sizes.

[21] TRF volume encompasses trades transacted off-exchange.

[22] ATS transactions within OATS are almost always double-counted because both the buy and sell side of a single transaction are reported as executions within OATS. I adjust for this double-counting by halving both share and dollar volume of ATS transactions for calculations in Table 1.

[23] For further information on ATS volume, see *Alternative Trading Systems: Description of ATS Trading in National Market System Stocks*. The ATS category includes ECNs, crossing networks, and some "ping" destinations (where all incoming orders are of the type immediate-or-cancel). Venues that generally have a single counterparty for all order flow (such as automated market-maker systems) generally do not designate their order flow as ATS order flow within OATS and would therefore fall into the OTC sample analyzed in this paper.

[24] See *Alternative Trading Systems: Description of ATS Trading in National Market System Stocks*. In that paper, I reconcile OATS reported volume to Form ATS-R reported volume during 2012Q2; doing so, I identify nine ATSs that do not differentiate their ATS trading within OATS. Using Form ATS-R reported volumes, I estimate these venues comprise 11.3% of ATS trading. In Table 1, I adjust observed ATS trading by 11.3% to account for these ATS executions that are not included in my sample. To the extent that I over- or under-estimate the magnitude of these unrepresented transactions, my estimate of other off-exchange order flow is affected because it is measured as a residual using the ATS volume estimation.

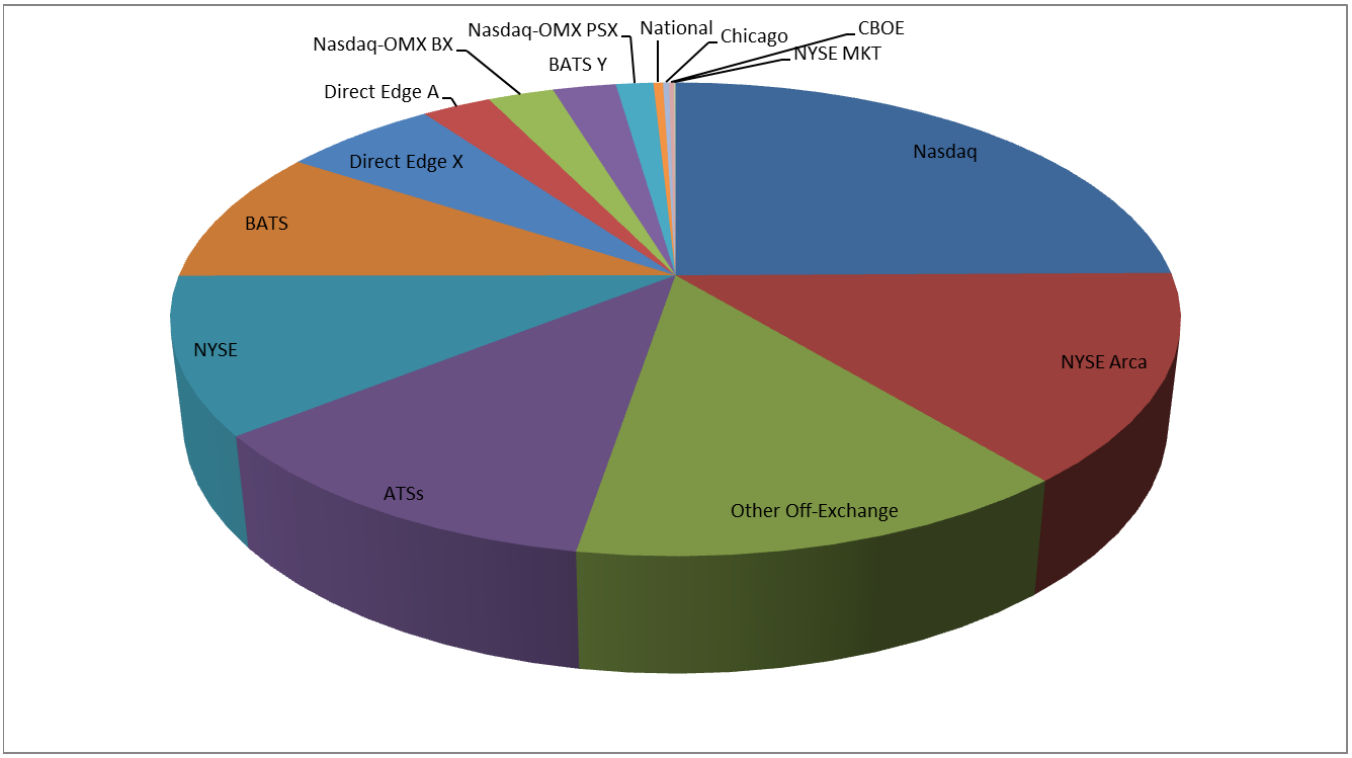
[25] To clarify my methodology: TRF Volume less Adjusted ATS Volume = Estimated Non-ATS OTC Volume. Adjusted ATS volume excludes odd-lots and is scaled to reflect 11.30% of ATS volume that I believe to be classified as non-ATS volume within OATS.

Table 1: Estimate of OTC Trading Activity Levels

	Dollar Volume	Share Volume
Total TAQ Volume (Bln)	1,149.60	34.81
TRF Volume (Bln)	325.40	10.72
% OTC	28.31%	30.79%
Total ATS Vol (Bln)	116.09	3.73
Less Odd Lots (Bln)	0.72	0.02
Round Lot ATS Vol (Bln)	115.37	3.72
Adjusted ATS Vol (Bln)	130.06	4.19
Estimated % ATS	11.31%	12.04%
Estimated Non-ATS OTC Vol (Bln)	195.33	6.53
Estimated % Non-ATS OTC	16.99%	18.75%

Figure 1 shows the dollar volume market share of all thirteen equity exchanges and the TRF. The TRF volume is partitioned into ATS and Other OTC volume. In addition to illustrating the fragmentation of U.S. equity trading, the figure shows that each segment of OTC trading (both ATS and Non-ATS OTC) exceeds the volume on most exchanges. Although I do not present the two categories of OTC trading in aggregate in Figure 1, if I did, this category would exceed the size of each of the thirteen registered exchanges.

Figure 1: NMS Dollar Volume Market Share by Venue, with TRF Volume Partitioned



IV. Market Share of OTC Trading Across Market Participants

In this section, I describe the market share of non-ATS OTC trading across market participants.

During my sample week, 255 distinct broker-dealers[26] report non-ATS OTC trading within OATS. I present summary statistics by market participant type in Table 2. All market share figures are relative, meaning they sum by construction to 100%.[27] The subsample of five Retail OTC MMs executes 37.23% of non-ATS OTC dollar volume (39.33% of share volume). The average non-ATS OTC order is for 1,451 shares; the average order for Retail OTC MMs is smaller at 882 shares.[28] The average aggregate fill size

[26] Records within OATS include a market participant identification code (MPID); I aggregate all activity at the Central Registration Depository (CRD) number level. A single CRD-level firm may be associated with many MPIDs.

[27] As discussed previously, some but not all non-ATS OTC trading volume reported to OATS is double-counted. To the extent that some classes of market participants are more likely to report volume that is not reportable to the consolidated tape, that class's market share would be upwardly biased, when market share is strictly considered as a fraction of reportable volume. To aid readers in gauging the magnitude of this bias, I report the proportion of dollar-volume of trading designated as riskless principal trading within OATS.

[28] My methodology for identifying an order as a non-ATS OTC order is contingent on the order receiving at least a partial fill. Consequently, I present no statistics on fill rates and interpret these statistics with caution. To the

for non-ATS OTC orders is 368 shares, and is nearly identical for Retail OTC MMs and other participants. Across the five Retail OTC MMs, there is considerable variability in average order and fill sizes.[29] Average order sizes within these five participants range from a minimum of 558 shares to a maximum of 8,148 shares; average aggregate fill sizes range from 316 shares to 1,096 shares.

Table 2: Market Share of Non-ATS OTC trading Across Market Participants

Participant Type	Dollar Volume Market Share	Share Volume Market Share	Orders (MM)	Fills (MM)	Average Order Size	Average Aggregate Fill Size	Riskless Principal Proportion (Dvol)
All	100.00%	100.00%	19.17	34.93	1,451	368	18.42%
Retail OTC MM	37.23%	39.93%	7.57	13.96	882	367	22.56%
Other	62.77%	60.07%	11.60	20.97	1,822	368	15.96%

Market share is fragmented across participants, with some participants executing significant OTC dollar volume while others execute very little. Table 3 provides statistics on cumulative market share and order and fill characteristics for the three, five, ten and twenty largest non-ATS OTC market participants. In my sample, the three participants with the highest market share are classified as Retail OTC MMs; collectively they execute 32.34% of OTC, non-ATS dollar volume of trading (35.00% of share volume). The ten largest participants execute 65.35% of OTC, non-ATS dollar volume (66.58% of share volume) and the largest twenty participants execute 84.95% of dollar volume (84.81% of share volume). The three largest participants have a smaller average order size than other groupings of participants. There is little variation in average fill size across the highest market share participants. Generally, average order size decreases with market share. The three largest firms have an average order size of 894 shares, while the largest twenty have an average order size of 1,320 shares. This may be due to retail order flow, which is predominantly received by firms with greater market share.[30]

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extent that smaller orders are less likely to receive a partial fill, my results on order sizes are upwardly biased. For this reason, I make no comparison to ATS order sizes.

[29] Although I endeavored to ensure the retail firms used to construct my Retail OTC MM sample had limited involvement in institutional trading and institutional asset management, I placed no such restrictions on the firms designated as Retail OTC MMs. I believe that the Retail OTC MM sample includes significant institutional order flow.

[30] NYSE Euronext provides statistics on its Retail Liquidity Program on their website (https://usequities.nyx.com/markets/rlp/statistics). For the five day period ending February 21, 2014, the median order size reported in the program was 294 shares. With an overall average order size of 1,451 shares in the non-ATS off-exchange market, I expect firms that receive significant retail order flow to have smaller average order

Table 3: Summary Statistics by Market Share Groupings

Firms	Retail OTC MMs (N)	Cumulative Market Share (Dvol)	Cumulative Market Share (Vol)	Average Order Size	Average Fill Size
Top 3	3	32.34%	35.00%	894	355
Top 5	3	44.84%	45.41%	1,154	365
Top 10	4	65.35%	66.58%	1,186	337
Top 20	5	84.95%	84.81%	1,320	360
All	5	100.00%	100.00%	1,451	368

Figure 2 presents the distribution of order and aggregate fill sizes[31] for the non-ATS OTC market. In this market, 20.80% of orders are for less than 100 shares, and 30.81% of orders are for exactly 100 shares. Large orders appear relatively common, with 15.99% of orders being for at least 1,000 shares although I interpret this cautiously because of a potential bias arising from exclusion of unfilled orders from my sample. Over 17% of fills are for less than 100 shares; 51.13% of fills are for exactly 100 shares.

sizes assuming that the NYSE Euronext RLP program's median order size is indicative of retail order sizes off-exchange.

[31] Fill sizes in Figure 2 are aggregated by order.

Figure 2: Order and Aggregate Fill Size Distributions for Non-ATS OTC Trading

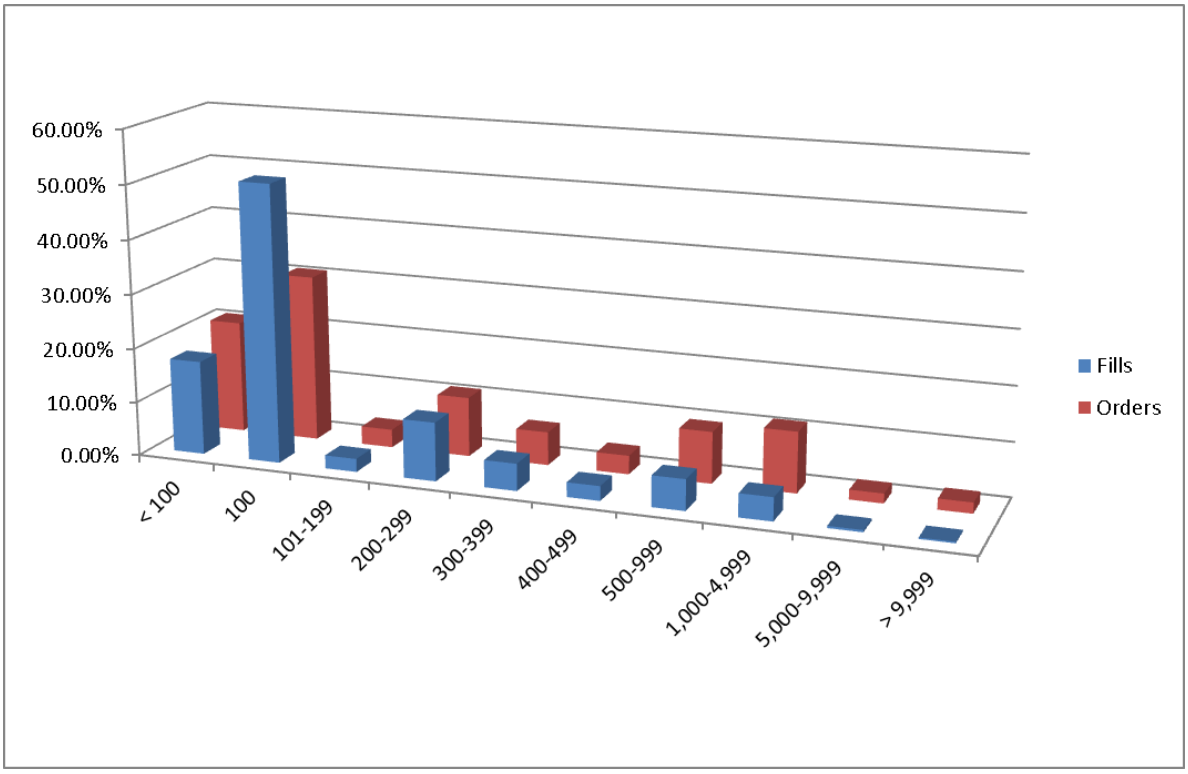
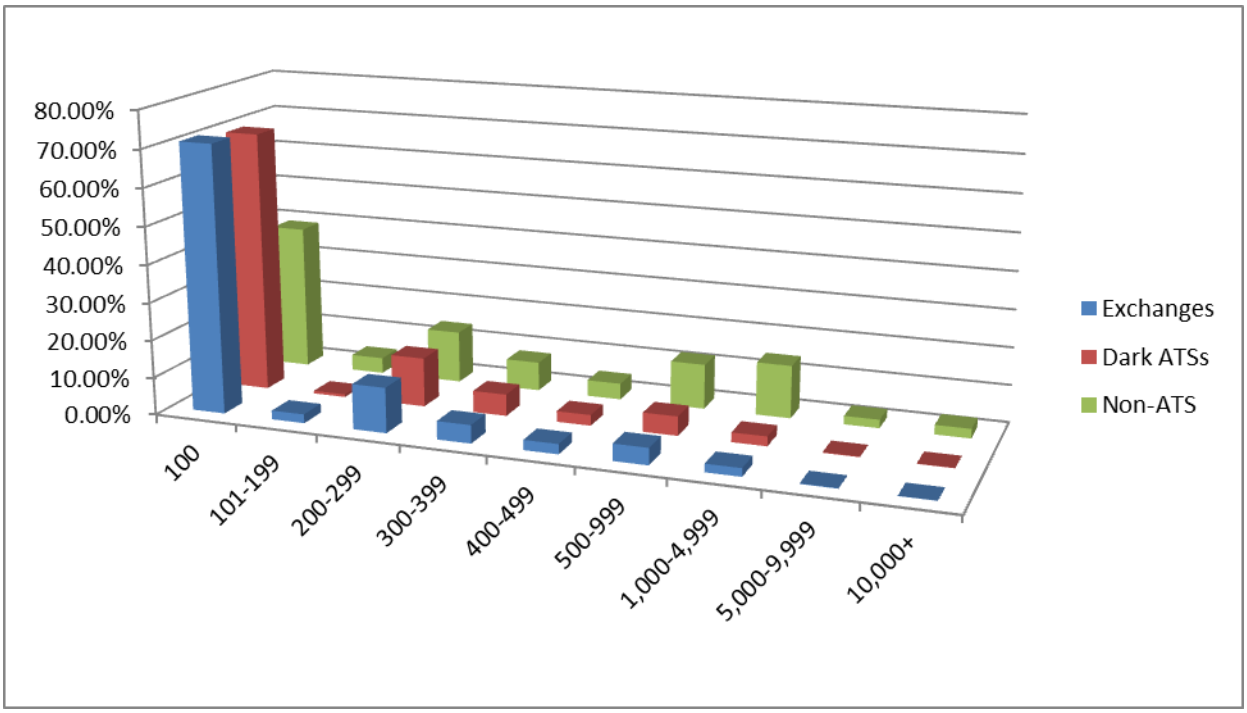


Figure 3 presents the distribution of fill sizes compared to dark ATSs and lit exchanges.[32] In this figure, all OTC fills are disaggregated, and I remove odd-lots so that I can directly compare trade size distributions to those observed on exchanges. As noted in *Alternative Trading Systems: Description of ATS Trading in National Market System Stocks*, trade size distributions between ATSs and exchanges are very similar. Trade sizes for non-ATS OTC trading are relatively large. On dark ATSs, 7.97% of trades are for 500 shares or more ; this figure is 30.92% for non-ATS OTC trades. Using the traditional block size of 10,000 shares, block trades comprise only 0.10% of dark ATS trading while they comprise 2.53% of non-ATS OTC trading. Although this result seems to suggest significant block trading occurs in the OTC market, I suspect that some (and perhaps much) of this trading represents the printing of a position that a broker-dealer has been acquiring from many venues back to a customer's account. Although I expect dealers to report this trading as riskless-principal trades when possible, some block dealers may report this trading as principal or agency trades.[33]

[32] Odd-lot trades are excluded from this analysis. I exclude data from Electronic Communication Networks (ECNs) where possible in this figure.

[33] The terms of trade negotiated with customers generally dictates the type of reporting used by the BD. However, I believe that BDs are cognizant of regulatory fees when they negotiate these terms with customers.

Figure 3: Trade Sizes for Exchanges, Dark ATSs and Non-ATS OTC Markets, Odd-Lots Excluded



V. Cross-Sectional Characteristics of Non-ATS OTC Trading

In this section, I present cross-sectional characteristics of non-ATS OTC trading.

Table 4 presents descriptive statistics of non-ATS OTC trading conditioned on market capitalization level and price level.[34] Order sizes tend to decrease with market capitalization level and are generally decreasing in share price within market capitalization groupings, although the relationship is not monotonic. There is little evidence of patterns across groups, although fill sizes appear somewhat higher for micro capitalization stocks. Within market capitalization groups, however, fill sizes are generally decreasing in share price. Finally, I note that the proportion of non-ATS OTC volume classified as riskless principal transactions is generally decreasing in market capitalization.

[34] Market capitalization levels are defined as follows: "Large" > $10 Bln.; "Medium" $1-10 Bln.; "Small" $500 MM-$1 Bln; "Micro" < $500 MM.

Table 4: Cross-Sectional Summary Statistics for OTC Non-ATS Trading

Market Capitalization Level	Price Level	Market Share of Retail OTC MMs	Average Order Size	Average Fill Size	Percentage Riskless-Principal Volume
All	All	37.30%	1,452	368	18.41%
Large	All	36.29%	1,250	360	17.10%
	> $100	44.59%	688	259	18.39%
	$85-100	40.71%	573	170	17.60%
	$20-85	30.29%	1,179	329	15.96%
	$5-20	41.98%	2,439	633	19.82%
Medium	All	34.85%	1,504	356	19.48%
	> $100	42.47%	689	174	19.92%
	$85-100	42.90%	656	177	24.20%
	$20-85	32.43%	1,167	265	19.69%
	$5-20	37.97%	1,790	408	18.16%
	< $5	43.19%	5,014	1,247	17.28%
Small	All	49.31%	1,770	374	22.42%
	> $100	74.21%	1,676	266	28.07%
	$85-100	49.99%	1,376	185	25.94%
	$20-85	48.56%	1,365	310	22.45%
	$5-20	49.18%	1,741	370	21.69%
	< $5	38.03%	2,912	522	23.41%
Micro	All	57.79%	1,847	430	26.38%
	> $100	43.56%	545	348	17.89%
	$85-100	69.24%	605	143	27.61%
	$20-85	60.22%	1,736	326	21.34%
	$5-20	55.30%	1,506	332	29.73%
	< $5	62.31%	2,351	562	31.90%

VI. Off-Venue Trading of ETFs

In Table 5, I compare the non-ATS OTC trading of ETFs to that of other NMS stocks. Generally, order and fill sizes for ETFs are larger than for other NMS stocks. A lower percentage of ETF trades are riskless-principal transactions.

Table 5: Summary Statistics for Non-ATS OTC Trading of ETFs

Security Type	N	Market Share of Retail OTC MMs	Average Order Size	Average Fill Size	Percentage Riskless-Principal Volume
All	6,684	37.30%	1,452	368	18.41%
ETF	1,178	39.22%	2,038	575	15.39%
Other	5,506	36.75%	1,384	349	19.29%

VII. Conclusion

This study provides general information on non-ATS OTC trading of NMS stocks and reveals a number of stylized facts.

I estimate that 16.99% of NMS dollar volume (18.75% of share volume) executes OTC without the involvement of an ATS. I estimate my subsample of Retail OTC MMs execute 37.23% of this dollar volume (39.93% of share volume). During my sample week, 255 broker-dealers report non-ATS OTC trading activity; market share is fairly concentrated, with the top twenty participants executing 84.95% of dollar volume (84.81% of share volume).

Using the traditional block size of 10,000 shares, block trades comprise 2.53% of non-ATS OTC trading. However, I believe some and perhaps much of this block volume represents aggregate trades from broker-dealers to their customers. In such a trade, a broker-dealer acquires a position through numerous small trades across multiple venues, then reports one (or more) large trades with his client.

Appendix A : Identification of Retail OTC Market Makers

I begin by identifying seven broker-dealers whose primary business model is retail brokerage.[35] A retail broker is a broker-dealer that tends to have individual investors as clients rather than institutions such as corporations, hedge funds, asset-management firms and other organizations. I then examine the Rule 606[36] disclosures of those firms for the second quarter of 2012.

For the sample of retail brokers, I note which market participants have been declared as destinations for non-directed order flow[37] in NYSE or Nasdaq listed stocks. Any participant that is a declared destination for three or more retail brokers is considered to be a Retail OTC Market Maker. I classify five participants as Retail OTC MMs through this methodology.

[35] I exclude some easily recognized retail brokerage firms because they also operate significant asset management businesses, such as mutual fund families. The asset management business of these firms entails business relationships that generate Rule 606 disclosures unrelated to retail brokerage. While the sample of retail brokerage firms excludes some sizeable retail brokerage firms, I have no reason to believe that the retail order flow from excluded retail brokerage firms tends to be routed to different destinations than the retail order flow from firms included in this methodology.

[36] Rule 606 requires broker-dealers to publicly disclose their routing practices for non-directed orders of NMS securities. For further information, see Rule 606 (http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=3fe9c57a5d2a787886b40c591f194ae5&rgn=div5&view=text&node=17:3.0.1.1.3&idno=17#17:3.0.1.1.3.0.114.34).

[37] In a non-directed order, the investor has not specified a venue for execution.

Appendix B: Tabular Data from Selected Figures

Tables 6 and 7 present the data from Figures 2 and 3, respectively. Methodological details are presented in the text discussing those figures in the body of the paper.

Table 6: Order and Aggregate Fill Size Distributions for Non-ATS OTC Trading

	< 100	100	101-199	200-299	300-399	400-499	500-999	1,000-4,999	5,000-9,999	> 9,999
Fills	17.36%	51.13%	2.42%	10.78%	4.98%	2.68%	5.69%	4.30%	0.40%	0.27%
Orders	20.80%	30.81%	3.34%	10.98%	6.14%	3.43%	9.50%	11.19%	1.80%	2.00%

Table 7: Trade Sizes for Exchanges, Dark ATSs and Non-ATS OTC Markets, Odd-Lots Excluded

	100	101-199	200-299	300-399	400-499	500-999	1,000-4,999	5,000-9,999	10,000+
Exchanges	71.21%	2.36%	12.01%	4.86%	2.67%	4.48%	2.20%	0.14%	0.07%
Dark ATSs	69.58%	0.73%	13.09%	5.77%	2.86%	5.13%	2.58%	0.16%	0.10%
Non-ATS	38.90%	4.22%	13.87%	7.75%	4.34%	12.00%	14.13%	2.27%	2.53%