2016

Prices, Trading Activity, And Market Quality In The Modern Otc Marketplace

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PRICES, TRADING ACTIVITY, AND MARKET QUALITY IN THE MODERN OTC MARKETPLACE

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DISSERTATION PRESENTED IN PARTIAL FULFILLMENT OF REQUIREMENTS FOR THE DOCTOR OF PHILOSPHY IN BUSINESS ADMINSTRATION, DEPARTMENT OF FINANCE, UNIVERSITY OF MISSISSIPPI

MAY 2016

ABSTRACT

In Part 1, I study over 10,000 OTC securities that are organized into one of three tiered marketplaces (OTCQX, OTCQB, and OTC Pink) based on the quality and quantity of information a firm makes available. My analysis adds to the literature by providing a more complete picture of trading in this market. I examine determinants of trading within the tiers and compare trading metrics of the biggest return winners and losers during the sample period. I also examine if day-of-the week effects previously documented for listed securities exist in the OTC market. A large portion of these securities are penny stocks trading under five dollars per share. In Part 2, I compare penny stock behavior across price partitions and OTC marketplace tiers. I also compare market quality metrics of penny stocks trading OTC to those of listed securities priced five dollars and under. I document positive externalities resulting from the lottery-like features of penny stocks. In particular, I find that OTC penny stocks trade more often than their non-penny counterparts. However, on average, increased investor interest does not lead to an improvement in bid-ask spreads for these securities relative to non-penny OTC securities. I also find that penny stocks designated to higher information tiers are more liquid than penny stocks designated to lower information tiers. Lastly, in Part 3, I examine short interest in OTC stocks by price, tier, and stock and firm characteristics to determine the effects of transparency on short selling in the OTC market. I also study the daily return performances of securities with differing levels of short interest to determine if OTC securities behave as predicted by a theoretical model provided by Ang, Shtauber, and Tetlock (2013). I find that larger, more liquid stocks, and stocks in lower information tiers, are easier to short. Additionally, although American Depository Receipts (ADRs) tend to display higher levels of institutional participation, these securities are more difficult to short than common stocks and ordinary shares. Overall, my results provide support for studies suggesting that the difficulty shorting OTC stocks adds to the lottery-like features of OTC securities.

DEDICATION

This dissertation is dedicated to my wife, who encouraged and supported me through this process, and to my two children.

ACKNOWLEDGEMENTS

I express my deepest appreciation to my advisors, Dr. Bonnie Van Ness and Dr. Robert Van Ness, and to my committee members, Dr. Travis Box and Dr. Brett Cantrell, for their guidance and support through this process.

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PART 1

INTRODUCTION

Electronic trading continues to produce noticeable liquidity benefits for listed securities. Modern markets, dominated by institutions and high-frequency trading firms, boast of low transactions costs, low volatility, and improved market depth and execution speeds (Angel, Harris, and Spatt, 2013). The over-the-counter (OTC) market, on the other hand, consists primarily of retail traders. Consequently, OTC securities are extremely illiquid, difficult to short, and exhibit highly skewed returns (Ang, Shatuaber, Tetlock, 2013; Eraker and Ready, 2015).[1] While liquidity for listed securities has been considered in depth, only a few studies examine liquidity in the OTC market. The primary goal of my analysis is to study the effects of information disclosure on market quality in the OTC market, specifically liquidity within the new OTC information tier designations. In 2007, OTC Markets Group established a tiered system of marketplaces for securities trading OTC.[2] Securities are currently organized into one of three tiered marketplaces (OTCQX, OTCQB,

[1] The OTC Markets Group reports that approximately 2,000 institutional investors trade OTC securities. Institutions hold an average of 26% of OTC stocks (Ang, Shatuaber, and Tetlock, 2013).

[2] OTC Market Group is formerly known as the National Quotation Bureau (NQB) and traces its history back to 1904. The NQB was established to aggregate and publish price information for securities trading OTC. Stock information was distributed on pink sheets of paper, which led to this market being referred to as the "Pink Sheets". On April 14, 1997, the NQB was sold. The NQB renamed itself Pink Sheets LLC in July 2000, and subsequently to Pink OTC Markets Inc. on March 31, 2008, and most recently changed its name to OTC Markets Group Inc. on January 18, 2011. OTC Markets Group is not a stock exchange nor a self-regulatory organization and is not regulated by FINRA or the SEC.

and OTC Pink) based on the quality and quantity of information firms make available.[3] The information tier designations of the securities in this study provide an ideal setting to examine the liquidity effects of information disclosure in the OTC market.

Previous studies suggest that firms providing voluntary disclosure find an improvement in liquidity, a reduction in cost of capital, and an increase in the number of financial analysts following a firm (Healy and Palepu, 2001). Diamond and Verrecchia (1991) find that information disclosure can reduce a firm's cost of capital through increased liquidity. Information disclosure allows shareholders and creditors to evaluate potential returns and monitor the use of capital (Beyer, Cohen, Lys, and Walther, 2010). Greater transparency improves market quality and reduces information asymmetry (Welker, 1995; Leuz and Verrecchia, 2000; and Bushee and Leuz, 2005). Due to reporting and transparency deficiencies and differences across firms, coupled with extreme prices and the prevalence of retail traders, price behavior and trading characteristics for OTC securities may differ markedly between tiers. Retail investors are likely to display greater levels of divergence of opinion, which is magnified in firms that are opaque and difficult to short (Ang, Shtauber, and Tetlock, 2013). Because disclosure of information resolves uncertainty and reduces divergence of opinion (Ang, Shatuaber, and Tetlock, 2013), stocks in higher information tiers should have higher valuations, trade more frequently, have less volatility and lower trading costs than stocks in lower information tiers.

My results indicate that firms in higher information tiers trade more frequently and have lower transaction costs than firms in lower information tiers. I also find that previously documented liquidity determinants for listed securities hold in the OTC market as well. In

[3] In 2013, the SEC recognized two of these tiers, OTCQX and OTCQB, as established public markets (SEC). As of 2015, over 10,000 global securities, with aggregate market capitalizations of $14.6 trillion, trade over $201 billion (dollar volume) annually in the tiered marketplaces operated by OTC Markets Group.

particular, I find that price, volatility, firm size, and competition among market makers are all significant determinants of firm liquidity. I document securities that move between the tiers indicating that firms pay attention to the new tier designation standards. After sorting firms on return performance over the sample period, I compare trading metrics of the top decile of performers to those in the bottom decile. Firms with the largest returns over the sample period are less liquid and experience less volatility than the bottom decile of performers. Given the difference in trader types (i.e. institutional versus retail) between listed and OTC markets, I examine if day-of-the week effects previously documented for trading metrics in listed securities are persistent in the OTC market as well. Similar to trading in listed markets, I find that trading activity is highest on Tuesdays and lowest on Fridays. Overall, my results shed light on the tiers within the OTC marketplace, which is relevant because firms must pay an application and ongoing annual fee to be listed on the OTCQB and OTCQX tier, but not on the OTC Pink tier.

It is important to study liquidity given its role in asset pricing and financial decision making (Chung and Zhang, 2014). Ang, Shtauber, and Tetlock (2013) suggest that OTC investors are largely concerned about stock liquidity, which in the OTC market includes the ability to trade a stock at all. Investors may also be interested in OTC stock liquidity based on evidence that liquidity is priced in stock returns (see, for example, Ang, Shatuaber, and Tetlock, 2013; Amihud and Mendelson, 1986; and Amihud, 2002). Liquidity premiums in the OTC market may be more taxing than those on securities trading on listed exchanges. The results of my OTC liquidity analysis are of interest to managers as well. For listed securities, stock liquidity is shown to be inversely related to cost of capital (Butler, Grullon, and Weston, 2005) and directly related to firm performance and manager compensation (Fang, Noe, and Tice, 2009). Consequently, if managers of firms trading on listed exchanges value stock market

liquidity, then managers of OTC firms may be even more concerned about the market liquidity of their securities, relative to managers of listed securities. Additionally, the differences in liquidity between the most liquid firms and least liquid firms in the OTC market may be more meaningful than similar differences between listed securities. In particular, given that more liquid firms have a lower cost of capital, a minor increase in liquidity for an OTC security market could have dramatic consequences on a firm's cost of capital, especially when compared to liquid securities trading on listed exchanges.

My results are also interesting in light of recent anecdotal evidence suggesting that some firms choose to avoid the costs associated with listing and instead choose to trade in the OTC market. These firms, either by default or design, acknowledge a preference for trading in the OTC market over the value of greater liquidity that results from trading on a listed exchange. My analysis of OTC stock liquidity is also valuable to firms both currently trading in this market as well as to ventures looking for a future trading home. Lastly, this study is unique in that it provides an opportunity to examine human trading behavior in an environment otherwise dominated by computers.

OTC MARKETPLACE AND TIER DESIGNATIONS

OTC securities are currently organized into a hierarchy of tiers based on the quality and quantity of information firms make available.[4] Companies on OTCQX meet the highest financial standards required by the OTC Markets Group, are current in their disclosures, are sponsored by a third-party investment bank or attorney advisor, pay an application and ongoing annual fees, and have a bid price of at least $0.10.[5] Firms within this tier are further classified as either *OTCQX U.S.*, *OTCQX International*, or *OTCQX Banks*. The *OTCQX U.S.* option is for "high growth and early stage companies seeking to build a more stable valuation and generate visibility in the investment community."[6] *OTCQX International* firms may already be listed on an international stock exchange and can qualify for this tier by making their home country disclosures available in English. Firms in this tier are not required to register with the SEC and can take advantage of SEC Rule 12g3-2b, which allows registration exemptions for some foreign securities. A majority of securities designated to the OTCQX tier are large international firms. *OTCQX Banks* is for established SEC- and non-SEC-reporting regional and community banks. In total, there are over 400 domestic and international securities, from over 20 countries that trade in the OTCQX marketplace. These firms represent $1.4 trillion in total market cap and trade over $36 billion (dollar volume) in 2014, which is a 22% increase over 2013. Firms such

[4] The information in this section is primarily obtained from otcmarkets.com.
[5] Sponsors for U.S. companies are called Designated Advisor for Disclosure ("DADs"), while sponsors for international firms are called a Principal American Liaison ("PALs"). These advisors provide guidance to firms navigating the publicly traded marketplace.
[6] SEC-reporting (non SEC-reporting) companies within this tier provide information through SEC's EDGAR system (OTC Disclosure & News Services).

as Adidas, Air France, Deutsch Telekom, Volkswagen, Heineken, and Technicolor trade in this tier.

The OTCQB tier is designed for entrepreneurial and development stage firms that do not qualify for the OTCQX. It was originally designed to identify companies that were current in their reporting to the SEC or bank/insurance regulator. However, on May 1, 2014, the OTC Market Group announced new OTCQB designation standards to make it a "true U.S. venture marketplace for engaged entrepreneurial and development stage companies." Securities on OTCQB must be current in their reporting to the SEC or bank/insurance regulator, undergo an annual verification and management certification process, and pay an application and ongoing fee. While there are no minimum financial standards, firms must have a minimum bid price of $0.01, and cannot be in bankruptcy.[7] Companies have 120 days from their 2014 fiscal year end to comply with the new designation standards. With compliance deadlines expiring at the end of July 2015, the OTC Market Group reports that over 1,000 companies have met the eligibility requirements for the OTCQB designation.

Either by "default, distress, or design," any security not designated to the OTCQX or OTCQB trades in the OTC Pink marketplace. Bankrupt firms, shell companies, and development stage companies are designated to the OTC Pink marketplace where there are no disclosure requirements or financial qualifications.[8] OTC Pink firms have variable reporting standards and are either unable or unwilling to provide adequate information and transparency. Based on the variety of firms within this tier, the OTC Markets Group further categorizes these firms into *Pink Current Information, Pink Limited Information,* or *Pink No Information* based on

[7] Firms must identify company officers, directors, and controlling shareholders, and also confirm total shares outstanding and total shares authorized.

[8] Many OTC stocks have five letter ticker symbols. The fifth character may be used to identify if a firm is in bankruptcy, delinquent in its filings, or may be used to identify the type of security, class of shares, or if the issue is a foreign security.

the level of disclosure. *Current Information* firms follow one of the allowed reporting standards and make their filings publicly available through the OTC Disclosure & News Service.[9] *Limited Information* firms include companies under financial distress or in bankruptcy, or a firm with financial reporting problems. These companies provide financial information via OTC Disclosure and News Service or have made a filing on EDGAR within the past six months. Lastly, as the designation suggests, *No Information* firms either are unable or unwilling to provide information, or if information is filed, it is older than six months.[10] This category includes defunct companies, along with companies that have questionable management and disclosure practices. The OTC Market Group reports that 90% of annual dollar volume in this OTC Pink marketplace is in securities with current information available. While broker-dealers pay a monthly fee to quote OTC securities, firms trading on OTC Pink do not encounter any application or ongoing annual fees. To be designated on OTCQX or OTCQB, however, firms must pay an application fee ($5000 and $2500, respectively) along with ongoing annual fees ($15,000 and $10,000, respectively). Approximately, 9,000 securities do not quote (yet may still trade) and are designated to the Grey Market. Table 1 provides a summary of the OTCQX, OTCQB, and OTC Pink tier designation standards.[11]

[9] OTC firms do not have to register with the SEC to trade, even though some OTC companies still file reports with the SEC (or a banking or insurance regulator). Other reporting firms may file via the OTC Disclosure & News Service, a platform provided by the OTC Markets Group where companies can provide information to investors. Companies trading on the OTCQX, OTCQB, and OTC Pink adhere to either an International Information Standard (Rule 12g3-2b allows non-U.S. companies with stock listed on a non-U.S. exchange to make publicly available the same information that is reported in their home country), U.S. Reporting Standard (domestic firms that are currently compliant to SEC or bank/insurance regulator), U.S. Bank Reporting Standard (banks with SEC-registered securities are current; those not registered with SEC must follow OTCQX rules for banks), or Alternative Reporting Standard (when SEC registration is not required, companies must still make information publicly available under Rule 10b-5.

[10] The SEC requires all companies to provide notice of dividends, stock splits, name changes, mergers and acquisitions, dissolutions, bankruptcies or liquidations ten days prior to the record date. The only way to be removed from one of the tiers is for all broker-dealers to stop quoting the security.

[11] All tables and figures are placed in the Appendix of each chapter of the dissertation.

TRADING

Companies can choose to avoid the costs of listing on an exchange and trade on the OTC. Thus, unlike listed firms on a primary exchange (such as the NYSE or NASDAQ), securities trading in the OTC marketplace are not "listed" and do not trade in a central exchange. They are either quoted by a broker-dealer or not quoted. OTC firms thus do not apply to trade in the OTC marketplace. Instead, at least one broker-dealer must file Form 211 with FINRA to begin quoting a firm.[12] Broker-dealers must be FINRA members and registered with the SEC, and are also subject to different state securities regulation designed to prevent fraud (i.e. blue-sky laws). Some brokers may not be willing to quote a new security initially, but instead wait for the stock to become "piggyback qualified" 30 days after another broker-dealer files Form 211. An OTC security may quote on FINRA's OTC Bulletin Board (OTCBB) and/or on the OTC Markets Group Alternative Trading System (ATS), OTC Link ATS.[13] While only SEC-reporting firms are eligible to quote on the OTCBB, no such restriction exists for firms that quote on the OTC Link ATS. OTC Link ATS quotes 99% of the OTCBB-eligible securities and has effectively replaced the OTCBB.[14] Additionally, the OTC Link ATS is the only quotation and trading

[12] There are exceptions to this. For example, if a delisted firm is already quoted by a broker-dealer, that security may be OTC eligible immediately.

[13] The OTC Link ATS is registered with the SEC and is operated by OTC Link LLC, a subsidiary of OTC Markets Group. On April 15, 2010, the OTC Market Group formed Pink Link ATS. On March 5, 2012, OTC Link became a registered broker-dealer and as of June 1, 2012 is operating as an SEC registered ATS. OTC Link ATS is regulated by FINRA and the SEC. In September of 1999, the NQB first introduced its an electronic quotation system to provide real-time quotes to broker-dealers.

[14] On July 9, 2014 FINRA proposed to cease operation of the OTCBB. In terms of market quality, Bruggemann, Kaul, Leuz, and Werner (2013) find that as a result of the new tiered regimes, the "Pink Sheets" has essentially caught up, if not surpassed OTCBB. By the end of their sample period, less than 1% of OTC firms quote exclusively on OTCBB. Bushee and Leuz (2005) state that it is cheaper for market makers to quote low-volume stocks on the Pink Sheets than on OTCBB.

system available for OTC securities. The OTC Link ATS offers real-time prices and links broker-dealers together so they can provide a trading experience similar to that of the NYSE or NASDAQ.[15] OTC Link ATS connects over 120 broker-dealers including Archipelago, BNY Mellon, Citadel, Credit Suisse, JP Morgan, Merrill Lynch, and UBS. These broker-dealers' OTC securities dealings are subject to FINRA Rules 5310 (best execution), 5320 (customer priority), 6460 (limit order display), 5220 and 6433 (quote integrity), 4560 (short position disclosure), 6622 (real-time trade reporting), and IM-2110 (no trades at prices better than or equal to customer limit orders), among others, just as their dealings in listed securities. Investors can place limit and market orders and trade through a variety of institutional, online, or retail broker-dealers. Broker-dealers may trade directly with other broker-dealers or execute trades internally. Trades must be reported within 30 seconds of execution.

[15] Unlike listed securities, there are typically no trading halts for the dissemination of (OTC) company news. Although free to trade anytime, trading typically occurs from 6 AM to 5 PM. Most trading activity occurs between 9:30 AM and 4 PM, Eastern Time. The OTC Markets Group even provides an opening bell ceremony similar to the NYSE called "Light up the Market." Unlike the NYSE, "Light up the Market" is a virtual, socially-enabled marketing and photo opportunity (available to OTCQX firms).

LITERATURE REVIEW

Given the small stream of literature examining the OTC market, I provide a comprehensive overview of research examining the OTC market and/or OTC securities. Only a few studies consider the OTC tier-based designations (Bruggemann, Kaul, Luez, and Werner, 2013; Jiang, Petroni, and Wang, 2013; and Litvak, 2009). Bruggemann, Kaul, Luez, and Werner find that investors pay attention to the information differences across firms and venues and transact accordingly. They fail to find return differences between the OTC information tiers and explain their results through retail investors' preferences for lottery-like assets coupled with short-sale constraints. They argue that sophisticated investors may withdraw from the market as a result, which makes it more difficult to price securities and, in turn, find return differences between the different information tiers. Bruggemann, Kaul, Leuz, and Werner believe the lower market quality they document is a result of low investor participation, and conclude that OTC firms tend to be small penny stocks with negative average returns and high return volatility (i.e. assets with lottery-like payoffs). Jiang, Petroni, and Wang look at the introduction of the tiered system and find that firms designated as *Pink Sheet Current Information* (*No Information*) experience an increase (decrease) in liquidity. Neither Bruggemann, Kaul, Luez, and Werner nor Jiang, Petroni, and Wang consider OTCQX firms because there are so few firms designated to this tier at the end of their sample periods. In a similar vein, Litvak finds that firms designated to the low disclosure tiers experience significant negative returns. Litvak states that the new tiers do not generate new information, but instead only summarize information that is already publicly available. Litvak proposes that her results are due specifically to firms' tier designations, not

underlying firm fundamentals and concludes that "prominent summaries of public information can affect stock prices."

The relation between increased information disclosure and reduced information asymmetry is supported by Bushee and Leuz (2005) who find that a regulatory change requiring OTCBB firms to comply with reporting requirements under the 1934 Securities Exchange Act leads to greater liquidity for some OTC firms. These results are in line with other studies that find reductions in information asymmetry (and increases in market quality) resulting from increases in levels of disclosure (see, for example, Welker, 1995; Leuz and Verrecchia, 2000; Marosi and Massoud 2007).

Other studies consider OTC stock liquidity, but typically examine liquidity immediately after a firm is delisted from an exchange and subsequently trades OTC (see, for example, Angel, Harris, Panchapagesan, and Werner, 2004; and Macey, O'Hara, and Pompilio, 2008). If the average closing price of a security listed on the NYSE or Nasdaq trades below one dollar over a consecutive 30-day period, that security may be delisted by the exchange. Macey, O'Hara, and Pompilio find that the failure to maintain the one dollar minimum share price is the most common reason Nasdaq firms are delisted, and the second most common reason NYSE firms are delisted. After a firm is delisted, market quality deteriorates. Share prices and volume fall, while quoted and effective spreads and volatility increase (Harris, Panchapagesan, and Werner, 2008; and Macey, O'Hara, and Pompilio, 2008). However, Macey, O'Hara, and Pompilio find that larger delisted NYSE firms moving to the OTC market are less affected than smaller firms. Dollar spreads for the larger delisted firms actually decline, partly as a result of the minimum tick size increments in each marketplace (one cent on the NYSE and sub-pennies in the OTC). Angel, Harris, Pauchapogesan, and Werner study involuntary delistings and find that the further

down the market hierarchy a firm falls during the delisting process, the greater the decline in its liquidity.

Overall, results from previous studies consistently find a reduction in liquidity and an increase in volatility around the delisting. By design, most of these studies pick up only a small portion of stocks trading OTC. Delisted firms typically have severe corporate issues and thus delistings are usually associated with negative events, negative returns, or poor future opportunities (see Shumway, 1997; Shumway and Warther, 1999; Marosi and Massoud, 2007; Leuz, Triantis, Wang, 2008). While firms with financial issues and reporting deficiencies trade in the OTC marketplace, there are many companies that are healthy, stable, and transparent. My analysis aims to provide a more complete picture of the OTC market by examining both stable and problematic OTC firms.

OTC asset pricing studies are also relevant to this study. Eraker and Ready (2014) find that the distribution of OTC stock returns is highly positively skewed. While most OTC stocks have negative average returns, some do well. They attribute this negative return premium for OTC securities to investors' preference for positively skewed lottery-like assets. These lottery preferences cost investors approximately one hundred and eighty billion dollars over their sample period. Ang, Shtauber, and Tetlock (2013) study OTC securities priced over one dollar and find that relative to listed stocks, OTC stocks have less intuitional investors, are more illiquid, and disclose less information. While the size, value, and volatility return premiums are similar to listed markets, the OTC market has an illiquidity (momentum) premium that is higher (lower) than in listed markets. Additionally, these authors state that OTC traders are primarily retail investors who may not pay attention to firms' fundamentals. Using Barber and Odean's discount brokerage house data, Nofsinger and Varma (2014) find that OTC investors are older

and more affluent, have more investing experience, trade more, and tend to have greater portfolio diversification than those that do not invest in OTC securities. Nofsinger and Varma also state that OTC investors, as a whole, do not seem to have the same characteristics as a lottery-seeking clientele, even though OTC stock returns are highly positively skewed. However, they find that investors in penny stocks (here, securities priced one dollar and under) are less affluent males who tend to have preferences for lottery like stocks. In sum, the authors conclude that investors in penny stocks seem to have different characteristics and trading behavior than investors in other OTC stocks priced over one dollar.

Analysts do not typically follow OTC stocks. Additionally, OTC stocks rarely receive media attention. The attention they receive is usually negative in nature, typically related to fraudulent activity, a spam campaign, or a "pump and dump" scheme. Freider and Zittrain (2007) find that stock spam impacts prices and that trading volume is directly related to spam e-mails.[16] Stocks earn positive returns on days prior to spam e-mails, but negative returns in the days after. Hanke and Hauser (2008) and Hu, McInish, and Zeng (2009) also find that stock spam campaigns impact prices and trading volume. Hu, McInish, and Zeng (2010) look at the content of spam emails and find that emails containing a short-term price target generate abnormal returns and trading volume. Bollen and Christie (2009) look at periods of extreme volume and volatility possibly induced by information shocks or "pump and dump" schemes. While they find average cumulative returns are over 20%, they do not find evidence of a continuation or reversal and suggest that "a large fraction of extreme volume periods reflect changes in fundamentals rather than manipulation."

[16] Freider and Zittrain describe the spam process: "Stock-touting spam asks a user to invest in a specific stock, and often concedes in its fine print that the spammer has a financial interest in touting those stocks. When [the investor] in a stock in which the spammer (or the spammer's client) holds a stake, spam recipients can maintain or drive up the price during the spammer's selling so that the stock can be liquidated at a profit."

DATA AND SAMPLE

Data in this study is provided by the OTC Markets Group and covers all trading days beginning February 18th, 2014, and ending March 6, 2015. The data contains comprehensive end-of-day/closing trade and quote information. The file is similar to daily CRSP files, but identifies information specific to OTC firms including tier designation, third-party sponsors, and a caveat emptor flag, among other items. OTC Markets Group also provides a security data file for February 18th, 2014, and March 6th, 2015, which contains shares outstanding.

There are a wide variety of global securities trading in the OTC marketplace, some of which are highly illiquid and trade infrequently during the sample period. Standard filters applied in studies of listed securities are not appropriate for an analysis of OTC securities. Additionally, previous studies of OTC securities restrict attention to only U.S. firms of certain market caps, prices, and levels of trading, thereby removing some of the variation in this marketplace. For example, Eraker and Ready (2015) exclude non-US stocks, ADRs, and securities priced under $0.01. Bruggemann, Kaul, Luez, and Werner (2013) exclude firms incorporated outside the US. Ang, Shtauber, and Tetlock (2013) require stocks to trade over $1.00 and have a market cap of at least $1 million. Since the OTC marketplace is home to numerous international firms and securities, I include all domestic and international firms of differing market caps and price levels that trade at least ten times during the sample period, but partition the data to more fully understand the activity of the average security within each partition. I consider all common stocks, ordinary shares, or American Depository Receipts

(ADRs), without additional restrictions on type or size.[17] ADRs tend to be larger OTC securities and have more institutional ownership than non ADRs (Jiang, Petroni, and Wang, 2013). To be included in my analysis, I require a firm to report shares outstanding on at least one of the two security data files. In Table 2, I classify the sample of firms according to tier designation and security type. Because many firms change tiers during the sample period, I provide a snapshot of the sample on the first and last day trading day during the period. See Panel A and Panel B. Next, in Panel C, I classify the sample according to average price. Over 70% of the sample are penny stocks trading under five dollars. Lastly, in Panel D, I classify each price partition according to tier designation. The largest percentage of firms in each price partition are found in the OTC Pink tier. Figures 1a and 1b further classify the sample according to price and tier. While over 70% of the sample has an average closing price below five dollars, over 80% of these securities have an average price below one dollar.

Table 3 presents summary statistics for the firms in the sample according to tier. OTCQX (OTCQB, OTC Pink) firms have an average share price of $10.00 ($25.89, $18.29) and an average daily price range expressed as a percentage of the closing price of 3.75 (9.31, 8.02). However, when considering median prices, the higher the tier, the greater the price. Next, considering relative spreads (closing bid-ask spread divided by the closing midpoint), the lower the tier designation, the higher a firm's relative spreads. OTCQX have a relative spread of 12.09%, whereas OTCQB's (OTC Pink's) average relative spread is 24.96% (34.82%). OTC stocks are extremely illiquid. To quantify their illiquidity, I use a metric similar to that used by Ang, Shtauber, and Tetlock (2013), Eraker and Ready (2015) and Bruggemann, Kaul, Luez, and Werner (2013). Their primary illiquidity measure is PNT, which measures the proportion of

[17] ADRs are issued by a U.S. depository bank and provide investors the opportunity to own and trade international securities in U.S. dollars during normal U.S. trading hours.

trading days in a month with no volume. This metric measures an "investor's ability to trade a stock at all, which is highly relevant in illiquid markets, such as the OTC markets" (Ang, Shtauber, and Tetlock). I define PNT as the percentage of days during the sample period that a security does not trade. OTCQX firms trade on more days than OTCQB firms, which trade on more days than OTC Pink firms. The average OTCQX (OTCQB, OTC Pink) security trades on approximately 64% (60%, 49%) of the days during the sample period (i.e. PNT is 35.74%, 40.36%, and 51.35%, respectively). The results for PNT are similar to those of Ang, Shatuber, and Tetlock and Bruggemann, Kaul, Leuz, and Werner. The average number of trades per day monotonically increases with the information tier. Also, while the average OTCQX firm is larger than the average OTCQB firm, some OTC Pink firms are extremely large. The average market capitalization for firms with the OTC Pink designation is greater than firms designated to OTCQX, although the median value for OTCQX firms is substantially larger than the median OTC Pink firm.

ANALYSIS AND RESULTS

OTC Markets Group promotes their marketplace as a minor league system of sorts for the listed exchanges, stating that some companies use their marketplace to improve their trading, transparency and trust among investors before moving up to a listed exchange. In 2014, 83 companies graduated to the NYSE, NASDAQ, or NYSE MKT, 22 to the TSX Venture Exchange in Canada, and five to the LSE AIM Market in the United Kingdom. Over 400 OTC companies have graduated to a listed exchange over the last five years. Bruggemann, Kaul, Luez, and Werner (2013) find that around 6% of OTC firms graduate to a listed exchange during their sample period and conclude that the OTC market is not a "breeding ground for young growth firms that eventually graduate to the traditional exchanges." All firms do not make it to the listed exchanges, of course. From the beginning of the sample period through December 31, 2014, I find over fifty firms that delist from a U.S. stock exchange and subsequently trade OTC.

While there are firms that move to/from a listed exchange, many OTC securities frequently move within the tiers of the OTC marketplace. As seen in Table 4, many firms switch tiers during the sample period, some more than once. 917 firms satisfy the standards of a higher tier and move up, while 1,430 firms fail to satisfy the reporting requirements of one tier and are designated to a lower tier. 322 (357) firms that quote (do not quote) in the OTC Pink (Grey market) stop (begin) quoting during the sample period. 432 firms move from the OTC Pink to OTCQB, the largest group of the tier risers. On May 1, 2014, OTC Markets Group announced new designation standards for the OTCQB tier. As a result of these new standards, 1,022

different securities in my sample move from OTCQB to OTC Pink. Some firms are serial changers. Over 20% of firms that switch tiers during the sample period do so more than once. Two securities change tier designations eight times during the sample, the most of any firms that switch. Bruggemann, Kaul, Luez, and Werner (2013) find that investors pay attention to the information differences across firms and venues and transact accordingly. The frequency of the tier changes I document indicates that some firms pay attention to the different standards and tier designations as well.

LIQUIDITY DETERMINANTS

While much is known about the determinants of trading in listed securities, the same does not hold for OTC securities. Given that many OTC stocks are penny stocks, the trading environment may be sufficiently different from that of regular stocks making "generalizations from penny stocks difficult" (O'Hara, Saar, and Zhong, 2014). Nofsinger and Varma (2014) document differing trading characteristics of OTC stocks based on different price levels and suggest that thin trading makes stocks difficult to price and sell. Since many OTC stocks are extremely illiquid, difficult to short, and display low levels of institutional ownership, relations between security characteristics and trading metrics are indeterminate. In an analysis of firms moving from a listed exchange to the OTC market, Macey, O'Hara, and Pompilio (2008) suggest that trading in different venues has different effects on prices. Consequently, price behavior and trading behavior for OTC firms may differ among the information tiers as well. These differences may be particularly apparent for firms in lower tiers since divergence of opinion among retail traders may be magnified in firms that are less transparent (Ang, Shtauber, and Tetlock, 2013). Liquidity is a primary concern in the OTC marketplace, especially considering that this market consists predominantly of retail traders. Listed firms in violation of an exchange's delisting standards oftentimes provide shareholders a warning of impending OTC illiquidity, similar to what is presented below by Lantronix Inc. in Form 10-Q filed with the SEC in 2003:

> "If our common stock was delisted…some or all of the following could be reduced, harming our investors: the liquidity of our common stock; the market price of our common stock; the number of institutional investors that will consider investing in our

> common stock; the number of investors in general that will consider investing in our common stock; the number of market makers in our common stock; the availability of information concerning the trading prices and volume of our common stock; the number of broker-dealers willing to execute trades in shares of our common stock; and our ability to obtain financing for the continuation of our operations….If our common stock were to be delisted…it could become subject to the SEC 'Penny Stock' rules. 'Penny Stocks' generally are equity securities with a price of less than $5.00 per share that are not registered on certain national securities exchanges or quoted on [a listed exchange]. Broker-dealers in our common stock would then be subject to the disclosure rules for transactions involving penny stocks, which require the broker-dealer to determine if purchasing our common stock is suitable for a particular investor. The broker-dealer must also obtain the written consent of purchasers to purchase our common stock. The broker-dealer must also disclose the best bid and offer prices available for our stock and the price which the broker-dealer last purchased or sold our common stock. These additional burdens imposed upon broker-dealers may discourage them from effecting transactions in our common stock, which could make it difficult for investors to sell their shares, and hence, limit the liquidity of our common stock."

I thus begin by analyzing the relation between *PNT*, percentage of days during the sample period with no trading, and firm and security characteristics. Schwartz (1988) finds that activity, risk, information, and competition are common liquidity determinants for listed stocks. More specifically, Chordia, Roll, and Subrahmanyam (2000) document common liquidity determinants that include volatility, volume, and price. I include price, firm size, and volatility as risk proxies, an SEC dummy variable along with tier designation dummy variables as information proxies, and the number of market makers quoting a security as a proxy for competition. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. This variable proxies information disclosure as firms registered with the SEC are required to disclose important financial information. I also include *ADR*, an indicator variable equal to one if the security is an American Depository Receipt, zero otherwise. Jiang, Petroni, and Wang (2013) state that ADRs tend to be larger OTC securities that have more institutional ownership than non ADRs. Additionally, OTC ADRs are similar to listed securities (Bollen and Christie, 2009). While the OTC setting, consisting of primarily retail traders, is extremely different from listed

exchanges, I hypothesize that activity, competition and information (risk) will be directly (inversely) related to liquidity. Also, because transparency results in an improvement in liquidity (see Healy & Palepu, 2001; Welker, 1995; Leuz and Verrecchia, 2000; Bushee and Leuz, 2005), I expect firms in higher information tiers to trade more frequently. I average each independent variable at the daily level and regress *PNT* on these firm and security characteristics to determine the relation of these variables over the sample period. The results for *PNT* are reported in the first two panels of Table 5. Since the dependent variable is bounded between 0 and 100, I present results for a Tobit analysis in Panel A and ordinary least squares (OLS) in Panel B. All variables are trimmed at the 1% and 99% levels to remove the impact of outliers and possible data errors.

In both panels, I find that higher priced OTCQX and OTCQB securities trade on fewer days of the sample period. However, considering only OTC Pink firms, higher priced securities trade more frequently, as seen in the negative relation to PNT. Across all specifications, stocks with greater daily price volatility (*Range)* and stocks with greater levels of competition among dealers (*Mkt Makers)* trade more frequently during the sample period. Larger firms tend to be more liquid as well, as seen in the negative relation between *Mkt Cap* and *PNT*. I find a positive relation between *ADR* and *PNT* suggesting that ADR securities are more illiquid than common stock and foreign ordinaries. This result is surprising given that ADRs are typically larger securities with more institutional ownership. The variables of interest in this analysis are the tier designation dummy variables. When adding these indicator variables, I find that OTCQB firms trade more often than OTC Pink firms (the omitted group). Similarly, the OTCQX dummy is negative, indicating OTCQX firms have lower levels of *PNT* (i.e. trade more frequently) than OTC Pink firms. These results are in line with Diamond and Verrecchia (1991) and Healy and

Palepu (2001), both studies which indicate that firms providing disclosure find an improvement in liquidity.

In Panel C and Panel D, I regress a firm's average number of (daily) trades on the same independent variables used in the analysis presented in Panels A and B. Panel C (Panel D) reports the results of a Tobit (OLS) analysis. The results in Panels C and D confirm those found in the first two panels of Table 5. Unlike in the first two panels, a positive coefficient in Panel C or Panel D indicates greater liquidity. However, when considering *# Trades*, higher priced firms trade less than lower priced firms in all categories except OTC Pink. The *SEC* indicator variable is also consistently negative in these panels indicating that firms registered with the SEC trade less throughout the day than firms not registered with the SEC. This result is in line with other studies suggesting that OTC investors may have preferences for stocks with lottery features. Lottery stocks are likely to be priced under one dollar and extremely opaque (Nofsinger and Varma, 2014).

I next consider another liquidity measure, closing bid-ask spreads. Copeland and Galai (1983) suggest the bid-ask spread should be inversely related to trading activity. Volume and number of trades are determinants of bid-ask spreads (Tinic, 1972; Tinic and West, 1972; Benston and Hagerman, 1974; Branch and Freed, 1977; and Stoll, 1978). Hasbrouck (1988) suggests that larger trades contain more information. Additionally, previous studies show that greater competition leads to smaller spreads (Demsetz, 1968; Tinic and West, 1972; Benston and Hagerman, 1974; Hamilton, 1976, 1978; and Branch and Freed, 1977). Bollen and Christie (2009) examine quoted spreads of securities trading on the Pink Sheets during 2004 and 2005, and find that return volatility, trading frequency, and the portion of trades made by a specific market maker explain bid-ask spreads. I examine similar determinants of bid-ask spreads to see

how these determinants hold within the OTC information tiers. Firms in higher information tiers trade more frequently. Coupled with a greater degree of financial transparency, closing bid-ask spreads should monotonically decrease with higher information tiers. Without trade level data, closing bid and ask prices provide the best glimpse into trading costs within each tier. The quotient of the closing bid-ask spread divided by the quote midpoint has a high degree of correlation with intraday TAQ data for listed securities (Chung and Zhang, 2014). Ang, Shtauber, and Tetlock (2013) state that the typical OTC investor incurs trading costs of less than 50 basis points per month. Even if trading costs are not significant for the average OTC investor, transactions costs could "limit the effectiveness of short-horizon arbitrage." Eraker and Ready (2015) state that transaction costs are important for any investor. OTC investors, especially those investing in penny stocks, are significantly affected by transaction costs (Nofsinger and Varma, 2014).

I regress closing bid-ask spreads on similar security and firm characteristics presented in Table 5. The results of this analysis are reported in Table 6. As in Table 5, I present the results of a Tobit (OLS) analysis in Panel A (Panel B), and trim all variables at the 1% and 99% levels. I find evidence supporting an inverse relation between trading activity and bid-ask spreads, as *# Trades* is negative and significant in most regression models. Since information is disseminated through trading activity, firms that trade more have tighter spreads. I find the Pink and OTCQX dummy variables are significant in the second regression reported in each panel, suggesting that bid-ask spreads are greater for OTC Pink securities than OTCQB securities, while those for OTCQX firms are smaller than OTCQB firms. Greater information disclosure here reduces closing spread percentages. *Range*, a price volatility measure, is positive in all regressions. Greater price volatility is reflected in wider bid-ask spreads, consistent with previous literature. I

next examine the effects of competition on the closing spreads by considering the number of broker-dealers quoting a security. In all models, I find an inverse relation between the number of broker-dealers making a market in a security and relative spreads. Greater competition leads to smaller spread percentages. Firm size is also a significant determinant in closing spreads. Across all specifications, I find that larger firms have smaller spreads. I find that firms registered with the SEC are more illiquid than firms not registered with the SEC. Similar to Table 5, ADRs also tend to be more illiquid than common stocks or ordinary shares. The coefficient of *SEC* and *ADR* are again surprising, but could be explained through investor preferences for OTC stocks with lottery-like features.

LOTTERY WINNERS

The last part of my analysis aims to examine the returns of firms with the largest (percentage) changes in price. In Table 7, I use a difference-in-means approach to determine trading differences between the top decile of (return) performers versus the bottom decile of performers. Eraker and Ready (2015) find that OTC stocks frequently undergo reverse stock splits. Due to data limitations, I calculate returns for only firms that, in March 2015, report shares outstanding within 10% of shares outstanding reported in February, 2014. Thus, any firms that report shares outstanding on only one date during my sample are dropped. I also do not have information on dividends paid during the sample period, so results in Table 7 should be interpreted with caution. Additionally, I require a firm to trade in either February or March in both 2014 and 2015. I also drop the top 1% and 99% of performers due to possible data errors, and consider the top and bottom deciles of the remaining securities comprised of over 500 securities each. The setup of the return performance test favors finding results primarily for low-priced securities. The bias towards low-priced securities is difficult to avoid, given that over 70% of OTC stocks are penny stocks, which are natural lottery candidates. However, as a consequence of the makeup of the sample, I expect the highest decile of return winners and losers to trade in the OTC Pink tier a trade under $1.00 per share. My results indicate just this: a large portion of the winners and losers during the sample period are OTC Pink securities that trade under one dollar. However, 12% of the biggest winners during the sample period are priced over five dollars.

In Panel B, after sorting firms on return performance over the sample period, I compare trading metrics of the top decile of performers to those in the bottom decile. I expect the highest decile of return winners to be more illiquid than the bottom decile of return performers. My results are in line with this expectation. The winners are more illiquid and trade less during the sample period (as seen in *Total Trades* and *PNT*). I also find that the portfolio of winners is less volatile than the portfolio of losers. Previous studies that find greater return volatility for stocks with lottery-like characteristics sort on return performance prior to measuring subsequent performance. Since my sort is completed ex-post, my results may not be in conflict with previous results. Differences in bid-ask spreads and firm size between the two groups are not statistically different from zero.

DAY-OF-THE-WEEK-EFFECT

Many academic studies of listed securities find a day-of-the-week effect in some trading metrics. Kiymaz and Berument (2003), for example, find that volume is highest (lowest) on Tuesdays (Mondays and Fridays). Similarly, Chordia, Roll, and Subrahmanyam (2001) find decreases in trading activity and liquidity on Fridays, but elevated levels on Tuesday. Since listed markets have higher proportions of institutional participation than the OTC market, I examine number of trades on each day of the week to find out how these metrics compare between venues. While the OTC setting consists of primarily retail traders, no theory provides predictions for other day-of-the-week patterns than that documented for listed securities. While this pattern could be different, I hypothesize that trading activity is highest on Tuesdays and lowest on Mondays and Fridays. Even though the OTC market consists primarily of retail traders, day-of-the-week trading metrics in the OTC market appear similar to those previously documented for listed securities. As presented in Figure 2, I find that Tuesdays have the highest number of trades, while Mondays and Fridays have the lowest.[18] In untabulated results, I regress number of trades on day-of-the-week dummy variables and find that Tuesdays (Fridays) have significantly more (less) trading activity than Wednesdays (the omitted variable). Trading activity on Mondays and Thursdays is not statistically different from trading activity on Wednesdays.

[18] These results hold within each OTC tier as well.

CONCLUSION

The modern OTC marketplace looks dramatically different than it did around the turn of the century. OTC Markets Group has revitalized this trading space, shedding its Pink Sheets image and improving trading for both investors and companies alike. OTC Markets Group now organizes securities in one of three tiers based on the "integrity of its operations, its level of disclosure, and its degree of investor engagement." These tier designations are an attempt to provide greater transparency to investors, thereby reducing fears and increasing investor confidence.

I provide a detailed examination of the OTC trading environment. In particular, I first provide a descriptive analysis of firms and trading activity within each tier. I also examine determinants of trading in this marketplace, with special attention to determinants within each tier, and find that firms in higher tier designations find greater liquidity. I compare trading characteristics of the top decile of performers versus the bottom decile of performers. The winners are more illiquid, trade less during the sample period, and are less volatile than the portfolio of losers. Lastly, I look at day-of-the-week effects in trading and find that, similar to listed markets, OTC trading activity is highest on Tuesdays.

Currently, little is known about OTC securities, and thus my analysis adds to the small stream of literature examining the modernized OTC marketplace. My paper describes in detail all three OTC tier designations and provides an overview of trading within each tier. Given the costs and benefits of improved liquidity discussed in this paper, my results are of interest to both traders and managers alike.

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APPENDIX

APPENDIX 1: TIERS SUMMARY

Table 1: Tiers Summary This table provides a short summary of the three OTC marketplace tiers: OTCQX, OTCQB, and OTC Pink. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on the OTC Link ATS or on the OTCBB and are designated to the Grey Market. The information below was retrieved from otcmarkets.com.

OTCQX- "The Best Marketplace"
For established, investor-focused companies
Meet Highest Financial Standards required by OTC Markets Group
Are Current in Their Disclosures
Receive third party advisory
Minimum bid price of at least $0.10
Pay application ($5000) and ongoing annual fees ($15,000)
Further classified as *OTCQX U.S, OTCQX International, OTCQX Banks*
International Firms (already listed on international exchange) may qualify for tier by making home disclosures in English
SEC Rule 12g3-2b allows registration exemptions for some foreign securities

OTCQB- "The Venture Marketplace"
For entrepreneurial & development stage firms
Current in reporting to U.S. or foreign regulator
No Minimum Financial Standards
Minimum bid price of at least $0.01
Must undergo an annual verification and management certification process
Pay application ($2,500) and ongoing annual fees ($10,000)

OTC Pink- "The Open Marketplace"
Marketplace for a wide variety of companies that are there by reasons of default, distress, or design
No Disclosure Requirements or Financial Qualifications
No Application or Annual Fees
Bankrupt firms, Shell companies, and development stage companies
Further classified as *Pink Current Information, Pink Limited Information,* or *Pink No Information*

Grey Market
Securities that are not traded on the OTCQX, OTCQB, or OTC Pink
No Market Makers/Broker-dealers are not willing or able to publicly quote these securities

APPENDIX 2: SAMPLE DESCRIPTION

Table 2: Sample Description This table classifies the sample of securities by tier designation, security type, and price. Because many securities change tier designations during the sample period, in Panels A and B, I present a snapshot of firm/security classifications on the first and last date of the sample period, February 18, 2014, and March 6, 2015, respectively. Ordinary Shares are common stock of foreign companies. American Depository Receipts (ADRs) are issued by a U.S. depository bank and provide investors the opportunity to own and trade international securities in U.S. dollars during normal U.S. trading hours. Panel C presents the number of securities throughout the complete sample according to price partition. Panel D categorizes OTC securities in different price partitions by tier designation. A firm that changes tiers during the sample period appear in all applicable partitions. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on OTC Link ATS or on OTCBB and are designated to the Grey Market.

Panel A: February 18, 2014 Snapshot

	OTCQX	OTCQB	OTC Pink	Grey	Total
ADRs	112	8	1,061	46	1,227
Common Stock	33	2,325	2,618	325	5,301
Ordinary Shares	171	175	1,259	1,936	3,541
Total	316	2,508	4,938	2,307	10,069

Panel B: March 6, 2015 Snapshot

	OTCQX	OTCQB	OTC Pink	Grey	Total
ADRs	111	5	1,073	24	1,213
Common Stock	95	1,509	2,932	622	5,158
Ordinary Shares	146	138	1,515	1,580	3,379
Total	352	1,652	5,520	2,226	9,750

Panel C: Full Sample Period by Average Price

	($0, $0.01)	[$0.01-$0.10)	[$0.10-$1.00)	[$1.00-$5.00)	> $5.00	Total
# Securities	2,005	1,915	2,243	1,333	2,972	10,468
% of Total	19.15%	18.29%	21.43%	12.73%	28.39%	100.00%

Panel D: Securities by Price and Tier

	($0, $0.01)	[$0.01-$0.10)	[$0.10-$1.00)	[$1.00-$5.00)	> $5.00
OTCQX	0.04%	2.48%	5.87%	4.19%	5.00%
OTCQB	10.48%	22.57%	32.60%	28.45%	18.44%
OTC Pink	66.71%	55.83%	42.62%	44.52%	52.29%
Grey	22.78%	19.12%	18.91%	22.84%	24.26%
Total	100.00%	100.00%	100.00%	100.00%	100.00%

APPENDIX 3: SUMMARY STATISTICS

Table 3: **Summary Statistics** This table provides summary statistics according to tier. *Price* is share price. *Range %* is daily high price minus daily low price divided by closing price. *Relative Spread* is the difference in the closing bid-ask spread divided by the closing midpoint. *Turnover* is daily volume divided by shares outstanding. *# Trades/day* is the number of trades in each security by day. *PNT* is the percentage of days a security does not trade. *Volume* is total shares traded per day. $ *Volume* is dollar volume per day. *Market Cap* is price multiplied by shares outstanding and is reported in millions. *#Shareholders* are the number of shareholders on record. Each variable is found at the security level first and then averaged.

Panel A: OTCQX

	Mean	p5	p25	Med	p75	p95	Sigma	N
Price	9.9957	0.0471	0.2072	1.038	10.7951	36.7267	32.3289	451
PNT	35.73	0	1.5	28.68	66.67	91.7	33.44	451
Spread %	12.09	0.32	1.98	5.83	16.33	42.3	17.04	451
# trades/day	31.25	1.55	2.51	5.02	18.19	149.12	95.7	451
Trade Size	3,570	168	455	1,403	4,701	13,316	5,346	451
Volume	45,800	416	3,094	17,782	45,096	179,514	95,984	451
$ Volume	361,435	611	3,227	12,837	52,138	1,762,187	2,362,840	451
Range %	3.75	0.25	1.08	2.52	5.42	10.85	3.76	451
Mkt Cap	6,142,768,635	2,564,224	12,895,178	44,290,797	598,852,712	28,262,715,390	33,674,208,275	451
# Mkt Makers	10.66	4.51	6.35	9.53	13.9	20.57	5.03	451
# Shareholders	18,240	61	139	398	1,000	2,500	167,978	93

Panel B: OTCQB

	Mean	p5	p25	Med	p75	p95	Sigma	N
Price	25.8878	0.0045	0.0713	0.4339	3.5546	30.3011	475.003	2721
PNT	40.3	0	5.28	37.5	70.94	93.58	33.3	2739
Spread %	24.96	1.55	5.48	13.99	31.89	88.81	30.85	2726
# trades/day	25.93	1.47	2.55	4.55	12.85	82.4	162.02	2721
Trade Size	36,876	164	656	2,484	8,493	81,907	226,253	2721
Volume	2,809,787	378	2,418	15,330	92,087	3,206,363	21,240,129	2721
$ Volume	99,415	374	2,565	8,521	25,801	192,004	1,154,578	2721
Range %	9.31	0.29	1.84	7.58	13.39	25.81	9.24	2715
Mkt Cap	1,568,561,734	302,687	2,732,140	10,909,731	31,962,910	295,274,000	12,536,812,804	2739
# Mkt Makers	11.02	5	8.13	10.6	13.41	18.35	4.19	2739
# Shareholders	25,783	22	77	194	529	2,000	907,191	1936

Panel C: OTC Pink								
	Mean	**p5**	**p25**	**Med**	**p75**	**p95**	**Sigma**	**N**
Price	18.2861	0.0005	0.0079	0.1588	6.1568	42.7934	218.1052	6504
PNT	51.31	0	17.36	57.74	83.4	95.47	34.21	6559
Spread %	34.82	0.52	3.24	21.73	50.88	122122	40.53	6522
# trades/day	15.55	1.2	1.77	2.85	7.61	59.53	59.81	6491
Trade Size	91,475	132	691	4,157	16,977	554,332	338,191	6491
Volume	2,235,815	300	2,924	16,884	89,615	9,233,366	12,462,481	6491
$ Volume	100,740	51	532	3,744	23,672	325,794	821,998	6491
Range %	8.02	0	0.66	3.83	12.35	27.83	10.31	6476
Mkt Cap	10,056,788,982	42,866	567,607	7,421,522	1,262,414,430	34,307,145,000	90,730,227,669	6559
# Mkt Makers	8.78	4	6	8	10.7	17.08	3.95	6555
# Shareholders	32,726	22	77	186	451	2,000	1,176,044	2926
Panel D: Grey								
	Mean	**p5**	**p25**	**Med**	**p75**	**p95**	**Sigma**	**N**
Price	21.96	0.0001	0.0313	0.5528	9.23	64.79	186.43	2494
PNT	82.78	32.08	78.49	90.94	95.47	100	20.74	2690
# trades/day	2.51	1	1.15	1.44	2.17	5.63	7.39	2496
Trade Size	45,481	158	1061	4,047	13,015	142,087	258,107	2496
Volume	119,675	215	1,656	7,282	26,859	269,328	806,976	2496
$ Volume	46,368	1.49	508	5,282	22,179	130,546	302,724	2487
Range %	2.75	0	0	0.19	1.66	17.13	7.22	2446
Mkt Cap	3,067,484,223	10,092	838,697	45,554,450	1,542,637,071	13,246,740,150	14,902,173,920	2690
# Shareholders	118,162	16	72	223.5	560.5	2,800	2,419,250	424

APPENDIX 4: TIER CHANGES

Table 4: Tier Changes This table presents the number of tier changes according to type. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on the OTC Link ATS or on the OTCBB and are designated to the Grey Market.

Panel A: Tier Changes		# Tier Changes	# Firms
	TOTAL	2622	2347
Tier Rise	OTCQB to OTCQX	71	71
	Pink to OTCQX	46	46
	Grey to OTCQX	1	1
	Pink to OTCQB	514	432
	Grey to OTCQB	10	10
	Grey to Pink	361	357
	Total	1003	917
Tier Drop	OTCQX to OTCQB	15	15
	OTCQX to Pink	49	48
	OTCQX to Grey	2	2
	OTCQB to Pink	1209	1022
	OTCQB to Grey	21	21
	Pink to Grey	323	322
	Total	1619	1430

Panel B: Serial Changers		
	# Tier Changes	# Securities
	1	1488
	2	240
	3	121
	4	42
	5	13
	6	4
	7	4
	8	2
	# Unique Securities	1914

APPENDIX 5: LIQUIDITY DETERMINANTS

Table 5: Liquidity Determinants. Panels A and B (Panels C and D) report determinants of *PNT* (*#Trades*). *PNT* is the percentage of days with no trading. *#Trades* is the average daily number of trades. The results reported below represent aggregated variables for each firm over the entire sample period using a Tobit analysis in Panel A and Panel C and ordinary least squares (OLS) in Panel B and Panel B. *Range* % is the average of the daily high price minus low price divided by the closing price. *# Mkt Makers* is the average of the number of market makers that quote a security throughout the day. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *ADR* is an indicator variable equal to one if the security is an ADR, zero otherwise. *OTCQB* is a dummy variable equal to one if the security is designated to the OTCQB tier, zero otherwise. *OTCQX* is a dummy variable equal to one if the security is designated to the OTCQX Tier, zero otherwise. All variables are trimmed at the 1% and 99% levels. Robust t-statistics are reported in parentheses.

$$PNT_i = \beta_0 + \beta_1 Price_i + \beta_2 Range_i + \beta_3 \#MktMakers_i + \beta_4 \log(MktCap)_i + \beta_5 SEC_i + \beta_6 ADR_i + \beta_7 OTCQB_i + \beta_8 OTCQX_i + \varepsilon_i$$

Panel A: Tobit	All	All	Pink	OTCQB	OTCQX
Price	0.0364	0.0174	-0.0996***	0.2983***	0.7689***
	(1.528)	(0.744)	(-3.645)	(4.916)	(3.851)
Range %	-1.1653***	-1.1442***	-0.8937***	-1.6200***	-2.1430***
	(-21.356)	(-20.821)	(-15.505)	(-13.924)	(-3.666)
# Mkt Makers	-6.2154***	-6.4377***	-7.1482***	-5.5639***	-5.8206***
	(-69.980)	(-70.043)	(-61.420)	(-34.584)	(-14.887)
Mkt Cap (log)	-1.6378***	-1.6397***	-1.0032***	-1.9606***	-9.8400***
	(-12.551)	(-12.706)	(-6.960)	(-5.718)	(-9.255)
SEC	-0.6274	-4.1565***	0.3398	-7.5300***	8.7469**
	(-0.901)	(-5.315)	(0.340)	(-5.406)	(2.233)
ADR	12.2387***	14.7702***	17.9819***	-17.0776	51.6212***
	(10.633)	(12.607)	(14.128)	(-1.560)	(10.167)
OTCQB		7.6829***			
		(9.378)			
OTCQX		-10.5189***			
		(-7.289)			
Constant	136.1992***	137.5638***	129.9881***	146.4454***	259.1042***
	(58.460)	(59.405)	(50.145)	(25.983)	(15.065)
Observations	7,009	7,009	4,491	2,141	377

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

Panel B: OLS	All	All	Pink	OTCQB	OTCQX
Price	0.0241	0.0071	-0.0949***	0.3041***	0.5876***
	(1.083)	(0.326)	(-3.834)	(5.218)	(3.354)
Range %	-1.0089***	-0.9953***	-0.8346***	-1.1922***	-1.9324***
	(-22.054)	(-21.608)	(-15.988)	(-13.955)	(-3.613)
# Mkt Makers	-5.2161***	-5.4055***	-6.0094***	-4.6462***	-4.7045***
	(-72.773)	(-72.622)	(-62.782)	(-35.256)	(-14.374)
Mkt Cap (log)	-1.3981***	-1.3963***	-0.8711***	-1.6035***	-8.4143***
	(-11.494)	(-11.589)	(-6.424)	(-5.241)	(-8.623)
SEC	-1.3253**	-4.3692***	0.0845	-8.4413***	5.6539
	(-2.088)	(-6.278)	(0.093)	(-7.075)	(1.639)
ADR	12.9779***	15.2280***	18.0411***	-8.5210	47.6558***
	(12.530)	(14.375)	(15.434)	(-1.190)	(10.045)
OTCQB		6.6710***			
		(9.263)			
OTCQX		-9.4637***			
		(-7.397)			
Constant	123.4315***	124.5674***	118.8163***	129.4762***	227.0574***
	(57.600)	(58.401)	(48.856)	(25.699)	(14.430)
Observations	7,009	7,009	4,491	2,141	377
R-squared	0.4803	0.4923	0.5009	0.4997	0.5766

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

$$\#Trades_i = \beta_0 + \beta_1 Price_i + \beta_2 Range_i + \beta_3 \#MktMakers_i + \beta_4 \log(MktCap)_i + \beta_5 SEC_i + \beta_6 ADR_i + \beta_7 OTCQB_i + \beta_8 OTCQX_i + \varepsilon_i$$

Panel C: Tobit	All	All	Pink	OTCQB	OTCQX
Price	-0.0372***	-0.0308**	0.0124	-0.0971***	-0.3988***
	(-2.839)	(-2.356)	(0.819)	(-3.546)	(-2.731)
Range %	0.7019***	0.7034***	0.5040***	1.1748***	0.9281***
	(20.400)	(20.022)	(14.407)	(15.515)	(3.513)
# Mkt Makers	2.7364***	2.7770***	2.9625***	2.6221***	2.5814***
	(34.067)	(33.218)	(26.591)	(19.043)	(7.774)
Mkt Cap (log)	0.7810***	0.7834***	0.3422***	1.4778***	5.4187***
	(11.378)	(11.407)	(4.679)	(7.303)	(6.145)
SEC	-4.1453***	-3.3612***	-5.1525***	-2.0071**	-11.3086***
	(-9.175)	(-6.713)	(-8.295)	(-2.194)	(-3.788)
ADR	1.2658*	0.7169	-0.3682	10.0440	-19.1021***
	(1.764)	(0.998)	(-0.517)	(1.435)	(-4.464)
OTCQB		-1.4748***			
		(-2.834)			
OTCQX		4.1690***			
		(4.128)			
Constant	-32.9520***	-33.4426***	-25.3927***	-49.7295***	-104.4683***
	(-23.192)	(-23.345)	(-16.682)	(-13.429)	(-7.101)
Observations	7,009	7,009	4,491	2,141	377

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

$$\#Trades_i = \beta_0 + \beta_1 Price_i + \beta_2 Range_i + \beta_3 \#MktMakers_i + \beta_4 \log(MktCap)_i + \beta_5 SEC_i + \beta_6 ADR_i + \beta_7 OTCQB_i + \beta_8 OTCQX_i + \varepsilon_i$$

Panel D: OLS	All	All	Pink	OTCQB	OTCQX
Price	-0.0406***	-0.0341**	0.0110	-0.0945***	-0.3944**
	(-2.605)	(-2.189)	(0.608)	(-2.936)	(-2.298)
Range %	0.7567***	0.7583***	0.5135***	1.3438***	0.9549***
	(18.351)	(17.847)	(13.221)	(12.807)	(3.414)
# Mkt Makers	3.0737***	3.1151***	3.3534***	2.9184***	2.8191***
	(28.832)	(27.991)	(21.994)	(16.202)	(7.157)
Mkt Cap (log)	0.8542***	0.8566***	0.3682***	1.6079***	5.5554***
	(10.607)	(10.636)	(4.408)	(6.571)	(5.500)
SEC	-4.7247***	-3.9273***	-5.8297***	-2.6543**	-12.0567***
	(-8.475)	(-6.305)	(-7.944)	(-2.232)	(-3.624)
ADR	1.3624	0.8030	-0.7420	8.7764	-18.3091***
	(1.563)	(0.919)	(-0.841)	(1.293)	(-3.819)
OTCQB		-1.5037**			
		(-2.255)			
OTCQX		4.2198***			
		(3.609)			
Constant	-37.1514***	-37.6486***	-28.7606***	-55.4929***	-108.8863***
	(-20.959)	(-21.120)	(-15.179)	(-11.919)	(-6.437)
Observations	7,009	7,009	4,491	2,141	377
R-squared	0.3177	0.3200	0.3321	0.3543	0.3633

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 6: DETERMINANTS OF SPREADS

Table 6: Determinants of Spreads. This table presents results for regressions of *Relative Spread* (closing ask minus closing bid divided by midpoint) as the dependent variable on a host of independent variables. Panel A presents the results from the Tobit model. Panel B presents results from OLS. *Price* is the average closing price. *# Trades* is the average number of trades per day. *Range* is the average of the daily high price minus low price divided by the closing price. *# Mkt Makers* is the average of the number of market makers that quote a security throughout the day. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *ADR* is an indicator variable equal to one if the security is an ADR, zero otherwise. *Pink* is a dummy variable equal to one if the security is designated to the OTC Pink Tier, zero otherwise. *OTCQX* is a dummy variable equal to one if the security is designated to the OTCQX Tier, zero otherwise. All variables are trimmed at the 1% and 99% levels. Robust t-statistics are reported in parentheses.

$$\%Spread_i = \beta_0 + \beta_1 Price_i + \beta_2 \#Trades_i + \beta_3 Range_i + \beta_4 \#MktMakers_i + \beta_5 \log(MktCap)_i + \beta_6 SEC_i + \beta_7 ADR_i + \beta_8 Pink_i + \beta_9 OTCQX_i + \varepsilon_i$$

Panel A: Tobit	All	All	Pink	OTCQB	OTCQX
Price	0.0065	0.0027	0.0259*	-0.0829**	0.0855
	(0.453)	(0.191)	(1.724)	(-1.971)	(1.160)
# Trades	-0.1006***	-0.0994***	-0.1104***	-0.1106***	0.0046
	(-9.201)	(-9.248)	(-7.263)	(-6.729)	(0.241)
Range	0.5749***	0.5450***	0.5107***	0.6347***	0.7764***
	(16.108)	(14.999)	(11.699)	(9.560)	(4.057)
# Mkt Makers	-2.1066***	-2.0117***	-1.7343***	-2.4998***	-1.2930***
	(-30.995)	(-28.177)	(-18.286)	(-19.805)	(-7.483)
Mkt Cap (log)	-3.0394***	-3.0548***	-3.5137***	-1.3211***	-4.4528***
	(-30.170)	(-30.448)	(-29.808)	(-5.771)	(-6.138)
SEC	1.7197***	2.6715***	-0.6131	4.5761***	-0.5131
	(3.249)	(4.765)	(-0.721)	(5.832)	(-0.326)
ADR	11.0059***	10.1476***	9.5394***	9.8115	21.6430***
	(17.379)	(15.566)	(13.261)	(1.397)	(7.257)
Pink		3.2383***			
		(5.889)			
OTCQX		-2.0387***			
		(-2.586)			
Constant	88.5308***	85.9290***	95.7993***	61.6958***	96.7822***
	(40.902)	(39.764)	(37.379)	(14.423)	(7.671)
Observations	6,959	6,959	4,447	2,137	375

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

Panel B: OLS	All	All	Pink	OTCQB	OTCQX
Price	0.0103	0.0061	0.0295*	-0.0834*	0.0849
	(0.676)	(0.400)	(1.839)	(-1.907)	(1.145)
# Trades	-0.1018***	-0.1004***	-0.1107***	-0.1127***	0.0045
	(-8.517)	(-8.525)	(-6.685)	(-6.139)	(0.232)
Range	0.5915***	0.5602***	0.5265***	0.6549***	0.7756***
	(13.290)	(12.322)	(9.584)	(7.983)	(4.022)
# Mkt Makers	-2.2423***	-2.1445***	-1.9026***	-2.6053***	-1.2926***
	(-28.762)	(-26.493)	(-17.367)	(-18.310)	(-7.429)
Mkt Cap (log)	-3.1508***	-3.1668***	-3.6403***	-1.3375***	-4.4442***
	(-25.996)	(-26.188)	(-25.414)	(-5.176)	(-6.110)
SEC	1.7618***	2.7315***	-0.5214	4.5507***	-0.5047
	(2.937)	(4.259)	(-0.531)	(5.179)	(-0.318)
ADR	11.6933***	10.8124***	10.4048***	9.8814	21.6123***
	(16.397)	(14.819)	(12.631)	(1.418)	(7.227)
Pink		3.3492***			
		(5.470)			
OTCQX		-2.3728***			
		(-2.862)			
Constant	92.0030***	89.3406***	99.8339***	63.2981***	96.6330***
	(35.050)	(34.442)	(31.819)	(12.918)	(7.641)
Observations	6,959	6,959	4,447	2,137	375
	0.4465	0.4508	0.4762	0.3837	0.4856

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 7: RETURN PERFORMANCE

Table 7: Return Performance. This table considers the trading determinants of the top decile of performers versus the bottom decile of performers over the sample period. Due to data limitations, I only calculate returns for firms reporting shares outstanding on February 14, 2014, and March 6, 2015, where shares outstanding on these dates are within ten percent of each other. I also require a firm to trade in either February or March of 2014 and also trade in February or March of 2015, in order to calculate the buy-and-hold return. Dividends are not considered in returns. I trim observations at the 1% and 99% levels. *# Trades* is total number of trades during the sample period. *Range %* is price range divided by the average of the daily high and low prices. *PNT* is the percentage of days during the sample period a firm does not trade. *# Market Makers* is the number of broker-dealers quoting each security. *% Spread* is the closing bid-ask spread divided by the quote midpoint. Lastly, *Mkt Cap* is the log of a firms market cap (price multiplied by shares outstanding).

Panel A:		**Winners**	**Losers**	
	# Firms	510	509	
	OTCQX	2%	3%	
	OTCQB	23%	29%	
	OTC Pink	75%	68%	
		100%	**100%**	
	>$5	12%	4%	
	$1-$5	7%	11%	
	<$1.00	80%	85%	
		100%	**100%**	
Panel B	**Winners**	**Losers**	**Diff**	**t-stat**
# Trades	1,186	3,193	-2,007***	-2.93
Range %	8.3	11.26	-2.96***	-6.20
PNT	61.15	47.09	14.06***	7.60
Mkt Makers	7.93	9.27	-1.33***	-6.40
% Spread	49.54	45.92	3.62	1.35
Mkt Cap	14.70	15.02	-0.32	-1.58

APPENDIX 8: OTC STOCKS BY PRICE

Figure 1a OTC Stocks by Price categorizes the full sample of OTC stocks according to price.

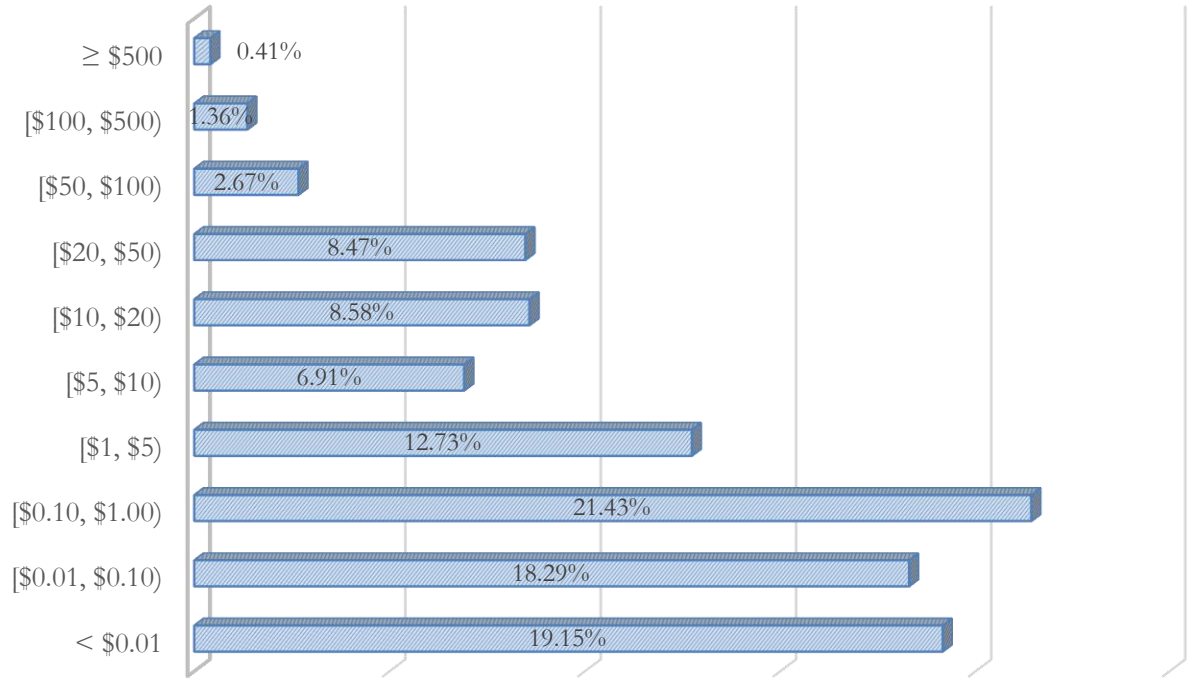
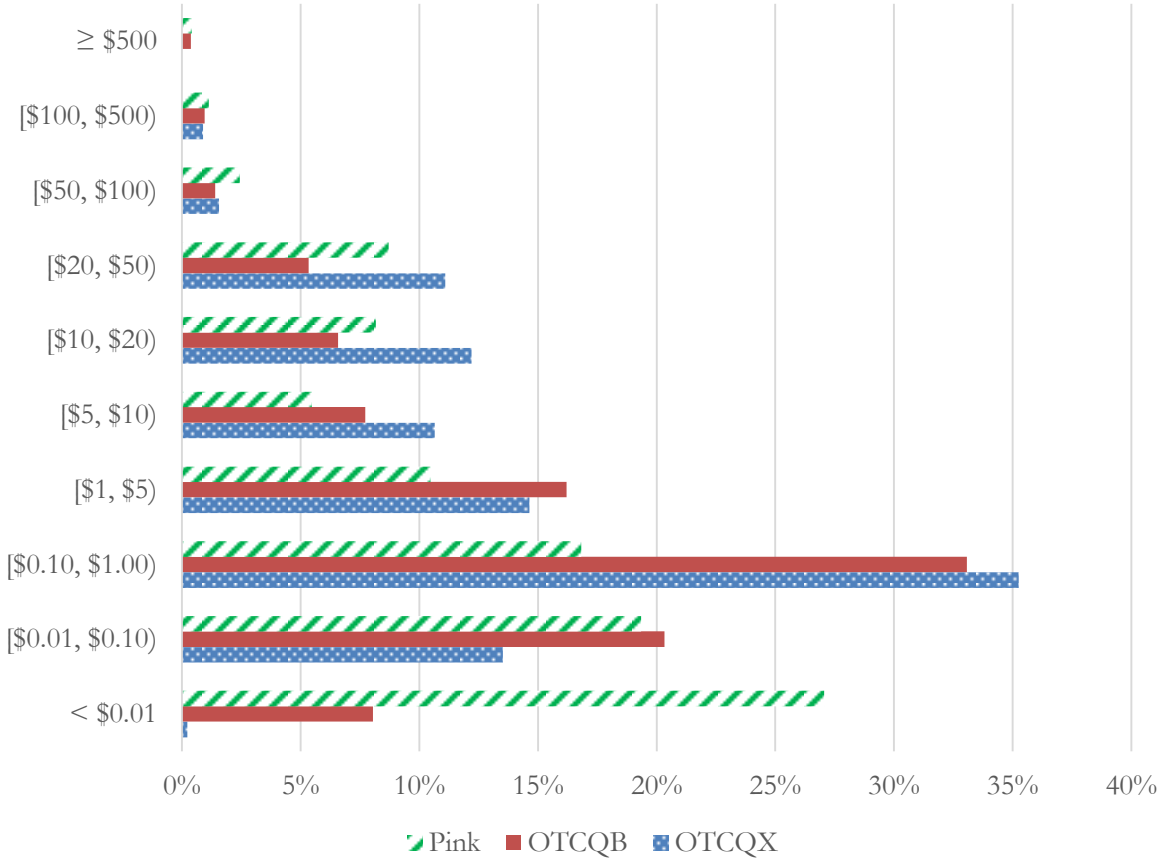
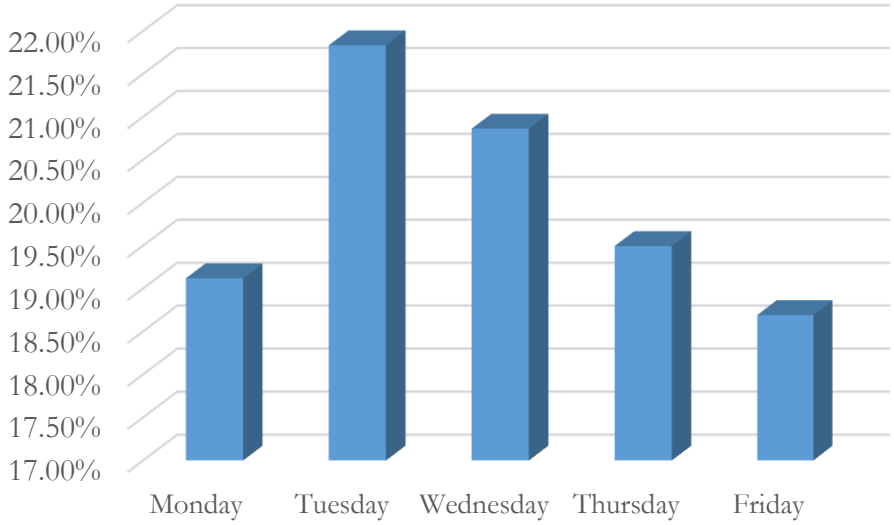


Figure 1b OTC Stocks by Price and Tier categorizes OTC stock prices by tier designation.



APPENDIX 9: TRADING BY DAY-OF-THE-WEEK

Figure 2: **Trading by Day-of-the-Week** This figure presents the percentage of all trades that occur on each weekday. Results for volume are quantitatively similar.



PART 2: AN ANALYSIS OF PENNY STOCKS AND LISTED SECURITIES TRADING UNDER FIVE DOLLARS

PART 2

INTRODUCTION

The Securities and Exchange Commission (SEC) defines a "penny stock" as a security trading under five dollars that is not listed on a national exchange.[19] Penny stocks provide investors the potential for unlimited upside at a small dollar investment. The downside, however, is that they are inherently risky and difficult to price because they trade infrequently, have variable reporting standards, and provide little information to investors. The SEC considers penny stocks speculative investments. Penny stocks are notorious for information asymmetry and due to their extreme prices, volatility, and illiquidity levels, are susceptible to deception, manipulation, fraud, and most recently to "pump and dump" spam campaigns (see, for example, Bollen and Christie, 2009, and Hu, McInish, and Zeng, 2010).

[19] Academic studies of OTC securities do not apply consistent identification criteria for penny stocks. Some define penny stocks as listed securities trading under five dollars, while other studies use a one dollar threshold. These distinctions are nontrivial. A penny stock, as defined by the SEC, refers to any security trading under five dollars that is *not* listed on the national exchange. It is these penny stock securities, as defined by the SEC, that are specifically subject to penny stock rules. The SEC defines a penny stock as "any equity security *other* than a security that: (a) is an NMS stock listed on a "grandfathered" national securities exchange, (b) is an NMS stock listed on a national securities exchange or an automated quotation system sponsored by a registered national securities association that satisfies certain minimum quantitative listing standards, (c) has a transaction price of five dollars or more, (d) is issued by a registered investment company or by the Options Clearing Corporation, (e) is a listed security futures product, or (f) is a security whose issuer has met certain net tangible assets or average revenues." See SEC Rule 3a51-1 for exemptions.

Penny stocks are typically shares of small companies that trade over-the-counter (OTC) and quote on OTC Link ATS and/or the OTC Bulletin Board (OTCBB). While only companies that file current financial reports with the SEC or bank/insurance regulator quote on the OTCBB, no such restriction exists on OTC Link ATS. As a result, most penny stocks quote exclusively on OTC Link ATS and are designated to the OTC Pink marketplace within the new tiered system of marketplaces established by OTC Markets Group in 2007.[20] As of 2015, approximately 10,000 global securities with aggregate market caps of $14.6 trillion trade over $201 billion annually in the tiered marketplaces operated by OTC Markets Group. While these metrics pale in comparison to listed markets, OTC securities are important especially considering they are primarily held by retail investors (Eraker and Ready, 2015). A large portion of OTC securities are penny stocks. As seen in Figure 1, almost 80% of OTC securities in my sample have an average closing price below five dollars. Over 80% of these have an average price below one dollar.

Recent studies give attention to stocks with lottery-like features (i.e. stocks with high return volatility and negative average returns). Kumar (2009), for example, identifies low-priced stocks with high idiosyncratic volatility and high idiosyncratic skewness as lotteries, and

[20] OTC securities are currently organized into one of three tiered marketplaces (OTCQX, OTCQB, and OTC Pink) depending on the quality and quantity of information firms make available. Firms on OTCQX meet the highest standards and are current in their disclosures. OTCQB is designed for entrepreneurial and development stage companies that are current in their reporting, but do not meet all of the conditions for the OTCQX designation. In 2013, the SEC recognized OTCQX and OTCQB as "established public markets." Either by "default, distress, or design," any security not designated to OTCQX or OTCQB trades in the OTC Pink marketplace. OTC Pink firms are either unable or unwilling to provide adequate levels of information and transparency. Based on the variety of firms within this tier, OTC Markets Group further categorizes these firms into *Pink Current Information, Pink Limited Information,* and *Pink No Information* based on the level of disclosure. *Pink Current Information* firms follow one of the allowed reporting standards and make their filings publically available through the OTC Disclosure & News Service. *Pink Limited Information* firms include companies under financial distress or in bankruptcy, or firms with financial reporting problems. These companies provide financial information via OTC Disclosure and News Service or make a filing on EDGAR within the most recent six month period. Lastly, as the designation suggests, *Pink No Information* firms are either unable or unwilling to provide information, or if information is filed, it is older than six months. This category includes defunct companies, along with dark companies that have questionable management and disclosure practices. Lastly, securities that do not quote are designated to the Grey Market.

suggests that individual investors have preferences for stocks with lottery-like characteristics. Lottery stocks are "cheap bets" and tend to be firms that are younger and smaller, exhibit less institutional ownership, and are less likely to pay a dividend (Kumar; and Eraker and Ready, 2015).[21] OTC stocks are primarily held by retail traders, are extremely illiquid and difficult to short, have few financial reporting requirements, and exhibit highly skewed returns. Consequently, OTC firms are stocks with lottery-like payoffs that tend to attract gamblers (Nofsinger and Varma, 2014; Ang, Shtauber, and Tetlock, 2013; Eraker and Ready; and Bruggemann, Kaul, Leuz, and Werner, 2013). Eraker and Ready find that OTC stocks are more illiquid and have lower returns than CRSP securities, and as a result, find it puzzling that investors are willing hold a portfolio of OTC securities when they have access to the CRSP universe of securities. Explaining their results through the model of Barberis and Huang (2008), Eraker and Ready argue that investors might have preferences for stocks with lottery features and are thus willing to accept negative returns for assets with lottery features.

Not all OTC stocks possess lottery-like characteristics. Nofsinger and Varma identify OTC stocks with lottery features as penny stocks priced under one dollar. While gambling preferences do not explain demand for all OTC stocks, Nofsinger and Varma find that preferences for stocks with lottery features explain demand for OTC securities priced under one dollar. Most importantly, because OTC securities are assets with lottery-like payoffs (Eraker and Ready, 2015, and Bruggemann, Kaul, Leuz, and Werner, 2013), and investors in penny stocks priced under one dollar have gambling preferences (Nofsinger and Varma, 2014), then penny stocks trading under one dollar may generate significantly more investor interest than those priced over one dollar. Consequently, the lottery-like characteristics of OTC penny stocks may

[21] While price is an obvious lottery stock identifier, Kumar concedes that individual investors are unlikely to calculate idiosyncratic volatility or idiosyncratic skewness to identify lottery stocks, but states that even less sophisticated investors will be able to distinguish between stocks with differing levels of these metrics.

be beneficial to the market quality of these securities relative to penny stocks above the dollar threshold. OTC penny stocks may display more favorable market metrics relative to low-priced, listed securities as well, especially since there are no mandated tick size rules for OTC securities. While small pricing increments could be detrimental to market quality (Bollen and Christie, 2009), Macey, O'Hara, and Pompilio (2008) find that dollar spreads decrease for some large, low-priced, actively traded (delisted) NYSE firms moving to the Pink Sheets as a result of the differences in pricing schemes between these two markets.

The above research question is part of my overall analysis of penny stock liquidity presented in this paper. I also compare liquidity metrics of OTC securities priced under five dollars to the liquidity of two reference groups. The first group consists of almost 2,000 non-penny OTC securities (i.e. OTC securities trading at a price above $5.00). Within this group, I analyze penny stock liquidity across price partitions and OTC marketplace tiers. In an analysis of firms moving from a listed exchange to the OTC market, Macey, O'Hara, and Pompilio (2008) state that trading in different venues has diverse consequences for stock prices. According to Nofsinger and Varma (2014), not only are penny stocks different than listed securities, they have different characteristics and trading behavior from other non-penny OTC stocks as well. The tier designation and listing status of the securities in this study provide a unique setting to examine the effects of information disclosure on prices and market quality. Information disclosure allows shareholders (and creditors) to evaluate potential returns and monitor the use of capital (Beyer, Cohen, Lys, and Walther, 2010). Greater transparency improves market quality and reduces information asymmetry (Welker, 1995; Leuz and Verrecchia, 2000; and Bushee and Leuz, 2005). Because disclosure of information resolves uncertainty and reduces divergence of opinion, penny stocks in higher information tiers (or

listing status) should have higher valuations, trade more frequently, have less volatility and lower trading costs than penny stocks in lower information tiers. The second comparison group is a sample of 674 low-priced, listed securities. 63 of these securities are priced between $0.10 and $1.00, while the remaining 611 securities trade between $1.00 and $5.00.

I document positive externalities resulting from the lottery-like features of penny stocks. In particular, I find that OTC penny stocks are more liquid than their non-penny counterparts. However, on average, increased investor interest does not lead to an improvement in market quality for these securities relative to non-penny OTC securities. I also find that penny stocks designated to higher information tiers are more liquid than OTC securities designated to lower information tiers. OTC securities, as a whole, are still extremely illiquid. I find that listed securities are more liquid than comparable OTC securities. However, results for daily price volatility of listed securities relative to OTC securities are mixed.

LITERATURE REVIEW

Few studies consider penny stock liquidity. I review some of the relevant literature on OTC securities (and listed securities) trading under $5.00 per share. Since this paper focuses on penny stock liquidity, I also provide a summary of related studies of OTC lottery features and/or OTC stock liquidity. Bruggemann, Kaul, Luez, and Werner (2013) analyze a sample of U.S. firms trading OTC and find that investors pay attention to the information differences across firms and venues and transact accordingly. While their study does not focus exclusively on penny stocks, they add price-level dummies for securities trading under a dollar and conclude that OTC firms tend to be small penny stocks with negative average returns and high return volatility, or assets with lottery-like payoffs. Bruggemann, Kaul, Leuz, and Werner fail to find return differences between the OTC information regimes and explain their results through retail investors' preferences for lottery-like assets coupled with short-sale constraints. They argue that such restrictions may lead sophisticated investors to withdraw from the market, which may make it more difficult to price securities and in turn find return differences between the different information tiers. Bruggemann, Kaul, Leuz, and Werner believe the lower market quality they document is a result of low investor participation. Jiang, Petroni, and Wang (2013) look at the introduction of the newly tiered OTC marketplace and find that firms designated as *Pink Sheet Current Information* (*No Information*) experience an increase (decrease) in liquidity. Similarly, Litvak (2009) finds that firms designated to the low disclosure tiers experience negative returns after the announcement of the new tiered system and concludes that summaries of publicly available information can affect stock prices.

Using discount brokerage house data from 1991-1995, provided by Barber and Odean, Nofsinger and Varma (2014) find that investors in OTC securities are older, wealthier, trade more, and tend to display greater portfolio diversification than investors that do not trade OTC securities. Nofsinger and Varma conclude that, as a whole, these investors do not seem to display lottery-seeking characteristics. However, they find that investors in penny stocks are, on average, less affluent, married, Catholic, African-American or Hispanic males who live in urban areas. These individuals have less diversified portfolios and trade more frequently than other OTC investors. Eraker and Ready (2015) document a negative return premium for OTC securities and attribute it to investors' preference for positively skewed lottery assets. Return distributions of OTC stocks are highly positively skewed meaning that most OTC stocks perform poorly, but some do really well.

Ang, Shatauber, and Tetlock (2013) restrict their attention to OTC securities priced over one dollar and find that, relative to listed stocks, OTC stocks have fewer intuitional investors, are more illiquid, and disclose less information. While the size, value, and volatility return premiums are similar to listed markets, the OTC market has an illiquidity (momentum) premium that is higher (lower) than in listed markets. Bushee and Leuz (2005) find an increase in liquidity for some OTC firms resulting from a regulatory change requiring OTCBB firms to comply with the Exchange Act (see footnote 2).

Some studies consider stock liquidity immediately after a firm is delisted from a national exchange and subsequently trades OTC. Macey, O'Hara, and Pompilio (2008) find that the failure to maintain the one dollar minimum share price is the most common reason NASDAQ firms are delisted, and the second most common reason NYSE firms are delisted. After a firm is delisted, market quality deteriorates. Share prices and volume fall, while quoted and effective

spreads and volatility increase (Harris, Panchapagesan, and Werner, 2008; and Macey, O'Hara, and Pompilio). Angel, Harris, Pauchapogesan, and Werner (2004) study involuntary delistings and find that the further down the market hierarchy a firm falls during the delisting process, the greater the decline in its liquidity. Overall, results from the previous studies mentioned immediately above find a reduction in liquidity and an increase in volatility around the delisting. Delisted firms typically have severe corporate issues (e.g., bankruptcy) that usually accompany negative events, negative returns, or poor future opportunities (Shumway, 1997; Shumway and Warther, 1999; Marosi and Massoud, 2007; and Leuz, Triantis, Wang, 2008). While firms with financial issues and reporting deficiencies trade in the OTC marketplace, they may differ from low-priced firms that remain on a listed exchange.

Analysts do not typically follow OTC stocks. Additionally, OTC stocks rarely receive media attention (Nofsinger and Varma, 2014). The attention they receive is usually negative in nature, typically related to fraudulent activity, a spam campaign, or a "pump and dump" scheme. Freider and Zittrain (2007) find that stock spam impacts prices and that trading volume is directly related to spam e-mails.[22] Stocks earn positive returns on days prior to spam e-mails, but negative returns in the days after. Hanke and Hauser (2008) and Hu, McInish, and Zeng (2009) also find that stock spam campaigns impact prices and trading volume. Hu, McInish, and Zeng (2010) look at the content of spam emails and find that emails containing a short-term price target generate abnormal returns and trading volume. Bollen and Christie (2009) look at periods of extreme volume and volatility possibly induced by information shocks or "pump and dump" schemes. While they find average cumulative returns are over 20%, they do not find evidence of

[22] Freider and Zittrain describe the spam process: "Stock-touting spam asks a user to invest in a specific stock, and often concedes in its fine print that the spammer has a financial interest in touting those stocks. When [the investor] in a stock in which the spammer (or the spammer's client) holds a stake, spam recipients can maintain or drive up the price during the spammer's selling so that the stock can be liquidated at a profit."

a continuation or reversal and suggest that periods of extreme volume are a consequence of changes in fundamentals, as opposed to manipulation.

As a result of fraudulent activities related to penny stocks in the 1980s, the Penny Stock Reform Act of 1990 (PSRA) gave the SEC greater regulatory power over penny stock issuers, brokers, and dealers and required broker-dealers to provide information on penny stocks to customers. These rules are designed for both brokers and customers to prevent deception and manipulative practices in these securities.[23] Beatty and Kadiyala (2003) study the impact of the Penny Stock Reform Act on the initial public offering (IPO) market and find that it reduces the number of IPOs, but does not have an effect on issuer quality.

Bradley, Cooney, Dolvin, and Jordan (2006) find that penny stock IPOs initially perform better than other IPOs, but do not perform as well as these other IPOs over the long-run. Additionally, they identify IPOs where the lead underwriter is subject to SEC enforcement actions related to market manipulation and find that these IPOs have significantly higher underpricing. Lastly, they find that gross spreads for penny stock IPOs are greater than other IPOs. Liu, Rhee, and Zhang (2015) consider listed penny stocks trading on the NYSE, Amex, and NASDAQ and find that these stocks are extremely illiquid, exhibit high idiosyncratic volatility, have high transaction costs, and display similar percentages of short interest compared to non-penny NYSE- and NASDAQ-listed securities. They also note that, contrary to popular belief, listed stocks priced five dollars and under show large percentages of institutional investors

[23] For example, the SEC requires broker-dealers to comply with Section 15(h) of the SEC Act of 1934 ("Exchange Act"), which includes "enhanced suitability and disclosure obligations to customers." In order for a broker-dealer to transact a penny stock for a customer, it must "(1) provide the customer with a risk disclosure document, as set forth in Schedule 15G, and receive a signed and dated acknowledgement of receipt of that document from the customer; (2) approve the customer's account for transactions in penny stocks, provide the customer with a suitability statement, and receive a signed and dated copy of that statement from the customer; and (3) receive the customer's written agreement to the transaction. The broker dealer must also wait at least two business days after sending the customer the risk disclosure document and the suitability statement before effecting the transaction." Additionally, broker-dealers must provide customers with information on the penny market along with information on the broker-dealer's aggregate compensation for such transactions. See Exchange Act Rules 15g for other penny stock rules.

(29% of listed penny stocks are held by institutional investors). Those penny stocks with greater institutional ownership earn significant abnormal returns, while those lightly held by institutions do not. Luft, Levine, and Larson (2001) compare OTCBB securities to listed securities trading from January 1, 1995, through December 31, 1998, and find that a portfolio of OTC securities is riskier and produces lower returns than portfolios of exchange-listed securities.

Since over 65% of my sample trades under one dollar, studies of securities trading around one dollar are also valuable to my analysis. Rhee and Wu (2015) examine NASDAQ's one dollar minimum bid price listing requirement and find it to be an appropriate screen to protect investors' interest in listed securities. Kwan, Masulis, and McInish (2015) look at the effects of the minimum pricing increments on order flow by identifying stocks crossing the one dollar threshold. They find that trading moves to dark trading venues when spreads are constrained by minimum pricing increments. Studies examining tick size (minimum price increment for quotes) and/or sub-penny prices oftentimes consider low-priced stocks near the penny-stock-price threshold (see for example, Bessembinder, 2000; O'Hara, Saar, and Zhong, 2014; and Buti, Consonni, Rindi, Wen, and Werner, 2014). The tick size for all U.S. stocks priced at one dollar or more is one cent, although trades can execute for fractions of a penny. O'Hara, Saar, and Zhong, in their study of relative tick sizes, state that the investment and trading environment for penny stocks is extremely different from non-penny stocks.[24]

[24] O'Hara, Saar, and Zhong (2014) use the term "penny stock" to reference listed securities priced below one dollar.

DATA

Data in this study is provided by OTC Markets Group and covers all trading days beginning February 18th, 2014, and ending March 6th, 2015. The data contains comprehensive end-of-day/closing trading and quoting information. The files are similar to a daily CRSP file, but supply information specific to OTC firms including tier designation, third-party sponsors, and a caveat emptor flag. OTC Markets Group also provides a security data file for February 18th, 2014, and March 6th, 2015, which contain shares outstanding. I use CRSP data beginning February 18, 2014, and ending December 31st, 2014, to compare penny stocks in the OTC market to low priced securities in listed markets.

There are a wide variety of global securities trading in the OTC marketplace, some of which are highly illiquid and trade infrequently during my sample period. Many academic studies of listed securities apply standard data screens that remove low-priced stocks trading five dollars and under from examination. These filters are justified because listing requirements of national exchanges oftentimes exclude low-priced stocks based on a minimum bid price threshold. As a result, the investing and trading environment for these stocks is different than that for non-penny stocks, which makes "generalizations from penny stocks difficult" (O'Hara, Saar, and Zhong, 2014). Recent studies of the OTC market also apply nontrivial restrictions on their sample, thereby removing some of the important variation in this marketplace. For example, Eraker and Ready (2015) exclude non-US stocks, ADRs, and securities priced under $0.01. Bruggemann, Kaul, Luez, and Werner (2013) exclude firms incorporated outside the US. Ang, Shtauber, and Tetlock (2013) require stocks to trade over $1.00 and have a market cap of at

least $1 million. Because my study is an analysis of penny (and low-priced) stocks, standard filters applied in the above studies are not appropriate for the analysis. In contrast, I consider all domestic and international securities alike, without restrictions on firm size. I require a firm to trade at least ten times and report shares outstanding during the sample period. For comparisons of penny stocks that trade OTC with penny stocks trading in listed markets, I restrict my attention to common stocks and ordinary shares.[25] While I do not apply rigorous filters, I partition my sample in numerous ways to present a clear picture of the average penny stock's behavior and activity in the OTC market. I examine over 9,000 OTC securities and 674 listed securities. Panel A of Table 1 categorizes the sample according to average price and listing status. Over 20% of the OTC sample is priced below one penny, while another 20% is priced between $0.01 and $0.10. Almost 2,200 firms trade between $0.10 and $1.00, the largest group in the sample. Over 1,000 OTC securities trade between $1.00 and $5.00.

The purpose of this study is to analyze OTC securities trading under five dollars. In order to do so, I compare trading of these securities to two reference groups. First, I compare penny stocks to almost 2,000 non-penny OTC securities (i.e. OTC securities trading at a price above $5.00). The last group consists of 674 low priced, listed securities. 63 of these securities are priced between $0.10 and $1.00, while the remaining 611 securities trade between $1.00 and $5.00. Panel B provides a picture of the OTC securities in the sample according to price and tier designation. Most of the securities within each price partition trade in the OTC Pink tier, followed by the OTCQB tier and then OTCQX. While not a tier designation, the Grey market hosts a large portion of each price group. Penny stocks in the Grey Market do not quote, yet may still trade. To give the reader an additional perspective on prices and tiers, I categorize each tier according to price in Figures 2a-2d. Unlike Panel B of Table 1 that categorizes prices according

[25] Ordinary shares are common stock of foreign firms.

to tier, Figure 2 presents the makeup of each OTC tier designation and Grey Market according to price.

Table 2 provides summary statistics for the securities in this study. The first five (last two) columns provide descriptive statistics for the OTC (listed) securities in this study. *PNT*, the primary liquidity metric within this stream of literature, represents the percentage of the number of days during the sample period that firm does NOT trade. Thus, higher measurements of *PNT* represent greater stock illiquidity. The most liquid OTC securities are those priced between $0.10 and $1.00 (i.e. *PNT* metric of 52.49). For the most part, lower priced OTC securities trade more frequently as well (as seen in *# Trades* and *Volume)*, yet have higher percentage spreads and greater price volatility (R*ange %*) than higher priced OTC securities. On average, there is a direct relation between the number of market makers providing quote for a stock and the price of the security. Listed securities appear to be significantly more liquid than their OTC counterparts. Listed securities trade almost every day of the sample period (PNT of 1.01 and 2.06, respectively), trade more throughout the day, and have much higher dollar volume measures as well.[26] I later compare the differences between the averages of OTC securities' liquidity metrics relative to listed securities to determine if these differences are indeed significantly different from zero.

[26] For listed securities, the number of trades is taken from CRSP and reflect the daily number of trades on NASDAQ. Even without including trades on other exchanges, listed securities trade significantly more than OTC securities.

HYPOTHESES AND RESULTS

While Eraker and Ready (2015) state that OTC stocks are lottery-like assets, Nofsinger and Varma find that not all OTC stocks possess lottery-like characteristics. Using Kumar's lottery identification strategy, Nofsinger and Varma identify OTC stocks with lottery features as penny stocks priced under one dollar. Additionally, they find that the socioeconomic characteristics of these investors are consistent with those of gamblers. While gambling preferences do not explain demand for all OTC stocks, Nofsinger and Varma find that preferences for stocks with lottery features explain demand for OTC securities priced under one dollar. If the average closing price of a security listed on the NYSE or NASDAQ is below one dollar over a consecutive 30-day period, that security may be delisted by the exchange. While the one dollar threshold is certainly consequential for listed securities, I investigate the significance of the dollar threshold in the OTC market. Because OTC securities are assets with lottery-like payoffs (Eraker and Ready, 2015, and Bruggemann, Kaul, Leuz, and Werner, 2013) and investors in penny stocks have gambling preferences (Nofsinger and Varma, 2014), then penny stocks trading under one dollar may generate significantly more investor interest than OTC stocks priced over one dollar. Consequently, the lottery-like characteristics of OTC penny stocks under one dollar may be beneficial to the market quality of these securities relative to low-priced, listed securities. Results from Davis (2015) also suggest a direct relation between *PNT* and *Price.* In other words, lower priced securities trade on more days during the sample period. I

thus posit that penny stocks priced under one dollar will display different trading characteristics than penny stocks trading over one dollar.

Hypothesis 1: OTC penny stocks trading under one dollar will be more liquid than OTC penny stocks trading over one dollar. In particular, penny stocks trading under one dollar will trade more frequently (as seen in number of trades), trade on more days, and have smaller closing bid-ask spreads than penny stocks priced over one dollar.

Hypothesis 2: Volatility (daily percentage price range) of OTC penny stocks priced under one dollar is smaller than those of OTC penny stocks priced over one dollar.

To address Hypothesis 1 and Hypothesis 2, I first report the results of a difference-in-means test in Table 3, and then the results of a more detailed multivariate analysis in Table 4. Nofsinger and Varma (2014) use the one dollar threshold to identify securities with lottery-like characteristics. In Table 3, I report the liquidity metrics between different granular price partitions, paying close attention to the dollar threshold. I find that securities priced below $0.01 are more illiquid than both penny stocks priced over $0.01 and all OTC securities priced over $0.01. Securities priced below $0.10 are also more illiquid than those above $0.10. However, there is a noticeable liquidity shift around the dollar threshold. First, there is no significant difference in PNT for penny stocks priced under $1.00 relative to penny stocks over $1.00. However, penny stocks under $1.00 have lower levels of *PNT* (i.e. are more liquid) than all OTC securities above the dollar threshold (including non-penny stocks). Additionally, all penny stocks (i.e. those priced under $5.00) are more liquid than their non-penny stock counterparts (i.e. those OTC securities priced over $5.00). When considering the number of trades per day, I find that

firms trading in sub-pennies trade more times per day than penny stocks over $0.01 as well as all OTC securities priced over a penny. I do not find a significant difference in *# Trades* for stocks under $1.00 relative to penny stocks over $1.00. However, if all OTC securities over $1.00 are included, those penny stocks under $1.00 are more liquid in comparison.

While penny stocks appear to trade more frequently than non-penny OTC securities, it does not appear that higher levels of trading reduce transaction costs or volatility enough to surpass their non-penny OTC counterparts. Both *Spread %* and *Range %* monotonically decrease with higher prices. All penny stock classifications have higher closing spreads and daily price volatility than those securities priced over five dollars. Thus, while some investors may prefer lower priced OTC securities due to their lottery-like features, the increased demand does not result in an improvement in market quality for these securities.

I next consider Hypotheses 1 and 2 in a multivariate setting. I regress *PNT* on price level indicator variables, controlling for price, range, the number of market makers quoting the security, firm size, and tier designation. I also include an SEC dummy variable equal to one if the firm is registered with the SEC, zero otherwise. Given the extreme difficulty shorting OTC penny stocks, the SEC dummy variable is used to proxy information disclosure. The regression results of the cross-sectional analysis are located in Table 4 and confirm those presented in Table 3. The first four columns present the outcomes of Tobit analyses, while the last four columns report OLS coefficients. Results for both are quantitatively similar. I run regressions on the complete sample and then within each tier to see if any differences arise. The dependent variable in all models is *PNT*. The independent variables of interest are the price level indicator variables. The price level dummy variable coefficients in regressions analyzing the complete sample, the OTCQX sample, and the OTCQB sample indicate that securities priced under five

dollars have lower levels of *PNT* (i.e. trade more frequently) than securities trading over five dollars (the omitted category). However, when considering only OTC Pink firms, I find either no significant difference in trading or higher levels of PNT for penny stocks relative to the non-penny stock group. The larger negative coefficients on the subpenny dummy, the dime dummy, and the dollar dummy relative to the $1.00-$5.00 dummy variable also indicate that penny stocks below $1.00 trade more often than penny stocks over $1.00. In total, low prices and even lower levels of transparency may appeal to some OTC investors.

Across all specifications, larger firms, firms with greater volatility, and those firms with greater market maker participation experience greater liquidity, as seen in the negative relation between these variables and *PNT*. Firms registered with the SEC are typically more liquid as well, except for those registrants within the OTCQX tier. Strict designation standards within the OTCQX tier may provide firms the opportunity to forego the costs associated with SEC registration altogether. When considering the regression containing all firms along with tier designation dummy variables, *Pink* and *OTCQB*, I find that OTC Pink and OTCQB firms have higher levels of *PNT* than the OTCQX group (the omitted group). Thus, foreshadowing the next section of my analysis, it appears that firms in the highest information tier are more liquid than firms in lower information tiers.

INFORMATION TIERS AND PENNY STOCK LIQUIDITY

Bruggemann, Kaul, Leuz, and Werner (2013) examine liquidity and price efficiency in OTC firms that disclose information relative to those that do not disclose information. However, due to the small number of firms in the tiers at the end of their sample period, Bruggemann, Kaul, Leuz, and Werner do not consider the current OTC Marketplace tier setting. Jiang, Petroni, and Wang (2013) look at the introduction of the newly tiered OTC marketplace and find that firms designated as *Pink Sheet Current Information* (*No Information*) experience an increase (decrease) in liquidity. Similarly, Litvak (2009) finds that firms designated to the low disclosure tiers experience significant negative returns after the announcement of the new tiered system, but before the implementation of the new classifications. Litvak concludes that "prominent summaries of public information can affect stock prices." Angel, Harris, Pauchapogesan, and Werner (2004) study involuntary delistings and find that the further down the market hierarchy a firm falls during the delisting process, the greater the decline in its liquidity. Ang, Shtauber, and Tetlock argue that retail investors are likely to display greater levels of divergence of opinion, which is magnified in firms that are opaque and difficult to short. As a result, price behavior and trading characteristics for OTC securities may differ dramatically between the new information tiers. Lastly, in an analysis of firms moving from a listed exchange to the OTC market, Macey, O'Hara, and Pompilio (2008) state that trading in different venues has different effects on prices.

Davis (2015) shows that OTC firms in higher information tiers are more liquid than firms in lower information tiers. Since his analysis considers all OTC securities, not just penny stocks, he does not differentiate between penny stocks and non-penny stocks. Given the findings from

Hypothesis 1 which indicate that penny stocks are more liquid than non-penny stocks, I next examine whether there are differences in penny stock liquidity between the OTC information tiers.

> Hypothesis 3: The higher the information tier on which an OTC penny stock trades, the more liquid (as seen in the percentage of days with trading activity, number of trades, and closing bid-ask spreads) the stock is.

Table 5 presents the results for difference-in-means tests for liquidity metrics, similar to that in Table 3. However, in this table, I compare liquidity metrics of similarly priced stocks, segregated by tier designations, in order to determine if penny stocks in higher information tier designations exhibit greater liquidity. Panel A presents the results for *PNT*. For each price partition above $0.10, OTCQX firms trade on more days than similarly priced securities trading in the OTCQB and OTC Pink marketplaces. OTCQB firms are also trade more often than firms trading on OTC Pink for all price partitions. In Panel B however, in terms of daily *# Trades*, OTCQX firms trade more frequently than OTCQB (OTC Pink) firms, but only for securities priced between $1.00 and $5.00 (penny stocks priced above $0.10). For all price partitions, OTCQB firms trade more often than OTC Pink firms. Lastly, the results for differences in *Spread %* are found in Panel C. For almost all categories, firms in higher information tiers have lower spreads than similar priced firms in lower information tiers. The two exceptions to this are the OTCQX-OTCQB and the OTCQB-Pink comparisons for firms priced between $0.01 and $0.10, and $1.00 and $5.00, respectively. Here, there is no significant difference in spreads between OTCQX and OTCQB, and percentage spreads for OTCQB firms are higher than that of OTC Pink firms. Generally, the results in Table 5 suggest that firms in higher information tiers are more liquid than firms in lower information tiers.

I extend this analysis to a multivariate setting and tabulate the results in Table 6. This analysis is similar to regressions of *PNT* on price level indicator variables located in Table 4. In Table 6, however, I consider only penny stocks and run a cross-sectional analysis within each price group. Panel A (Panel B) presents results of Tobit regressions with *PNT* (*Spread %)* as the dependent variable. The independent variables of interest are *Pink* and *OTCQB*, which are indicator variables denoting a firm's tier designation. In all specifications in both panels, both *Pink* and *OTCQB* are positive, indicating that firms within these tiers have higher levels of *PNT* and higher percentage spreads than OTCQX firms (the omitted group). Thus, firms in the top tier, OTCQX, are the most liquid OTC securities. The magnitude of the coefficients on *Pink* and *OTCQB* differ depending on price levels. Also of interest are the price indicator variables in the first regression of each panel. Here, I consider all penny stocks and find that, after controlling for a host of factors that affect *PNT*, securities trading at subpenny levels (the omitted group) are the most liquid group in the study. In Panel A, all price level indicator variables have higher levels of *PNT* than the omitted subpenny group. Similarly, in Panel B, all price level dummy variables indicate that penny stocks over $0.01 have higher closing spreads than the subpenny group. Considering the results from Panels A and B jointly, securities trading at prices below a penny not only trade more frequently than other penny stocks, but have the lowest percentage spreads as well. The most natural lottery candidates are the most liquid group in the study after controlling for factors that influence *PNT* and *Spread %*.

OTC VERSUS LISTED

Results from previous studies find a decrease in liquidity and an increase in volatility around a firm's move from a listed exchange to the OTC market. Both share prices and volume decrease, while volatility and spreads (quoted and effective) increase (see Harris, Panchapagesan, and Werner, 2008; and Macey, O'Hara, and Pompilio, 2008). As mentioned earlier, Angel, Harris, Pauchapogesan, and Werner (2004) study involuntary delistings and find that the further down a firm falls during the delisting process, the greater the decline in its liquidity.

O'Hara, Saar, and Zhong (2014) state that the trading environment for penny stocks is different from non-penny stocks. Nofsinger and Varma (2014) conclude that penny stocks seem to have different characteristics and trading behavior than other OTC stocks priced over one dollar. Additionally, in an analysis of firms moving from a listed exchange to the OTC market, Macey, O'Hara, and Pompilio (2008) state that trading in different venues has different effects on prices.

Liu, Rhee, and Zhang (2015) find that 29% of listed penny stocks are held by institutions. Those held by institutions earn significant abnormal returns, while penny stocks lightly held by institutions do not. OTC penny stocks, on the other hand, are primarily held by retail investors and display less institutional ownership (Ang, Shtauber, and Tetlock, 2013; and Eraker and Ready, 2015). OTC securities, in particular OTC penny stocks, are assets with lottery like payoffs (Eraker and Ready; and Nofsinger and Varma, 2014). Also, OTC securities are difficult to short (Ang, Shatauber, and Tetlock). Ang, Shtauber, and Tetlock (2013), Eraker and Ready

(2015), and Bruggemann, Kaul, Luez, and Werner (2013) document negative average stock returns and high return volatility for OTC stocks and suggest that these results are consistent with investors seeking assets with lottery features. Lastly, due to the listing requirements, listed low-priced securities are typically more transparent than penny stocks trading OTC. Ang, Shatuaber, and Tetlock state that financial disclosure resolves uncertainty and reduces divergence in opinion. Thus, listed firms, which are required to register with the SEC, should display less divergence of opinion resulting in lower levels of daily price volatility.

Hypothesis 4: Low-priced, listed stocks (i.e. listed securities priced under $5.00) are more liquid (as seen in number of trades, percentage of days with trading activity, and closing bid-ask spreads) than OTC penny stocks.

Hypothesis 5: Daily price ranges for OTC penny stocks are larger than those of listed securities trading under five dollars.

Summary liquidity metrics presented in Table 2 indicate that listed securities are more liquid than their OTC counterparts. To confirm the results presented in Table 2, I employ a difference-in-means test to compare liquidity metrics of listed securities relative to OTC securities. The results of these tests are reported in Table 7. This time, I test liquidity metrics between three groups based on the prices of the listed sample: those under $5.00, those specifically priced between $0.10 and $1.00, and those priced between $1.00 and $5.00. Regardless of liquidity metric (*PNT, # Trades, Spread %)* or price partition, low priced listed securities are overwhelmingly more liquid than penny stocks. While listed securities under $5.00 exhibit greater price volatility throughout the trading day relative to OTC penny stocks, OTC securities priced between $1.00 and $5.00 are less volatile than comparable listed securities.

CONCLUSION

Previous studies of OTC securities apply heavy sample restrictions that remove some of the nontrivial variation in OTC securities. For example, Eraker and Ready (2015) exclude non-US stocks and those under $0.01. Bruggemann, Kaul, Luez, and Werner (2013) exclude firms incorporated outside the U.S. Lastly, Ang, Shtauber, and Tetlock (2013) require stocks to trade over $1 and have a market cap of at least $1 million. While these filters may be appropriate for their studies, I intentionally study the securities filtered out from other research. A large portion of OTC securities are penny stocks trading under $5.00. I first quantify the trading activity of OTC penny stocks and compare liquidity metrics of these stocks relative to both non-penny OTC stocks as well as to low-priced, listed securities.

Previous literature documents the lottery-like features of OTC securities. Until this point, however, few studies have looked for trading consequences of these lottery characteristics. In particular, I find that the lottery-like characteristics of OTC securities seem to generate more investor interest in penny stocks than in their non-penny counterparts. Penny stocks trade more than the higher priced, more "legitimate" OTC securities. On average, however, increased investor interest does not lead to an improvement in market quality. In a comparison of liquidity metrics between listed and OTC securities, I find that listed securities are more liquid than comparable OTC securities.

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APPENDIX

APPENDIX 1: SAMPLE DESCRIPTION

Table 1: Sample Description

This table classifies the sample of securities by price, listing designation, and tier designation for OTC securities. Panel A provides the number of securities in the sample according to price partition and listing status. Panel B categorizes each price partition by tier. The sample consists of common stocks and ordinary shares. Ordinary shares are common stock of foreign companies. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on OTC Link ATS or on OTCBB and are designated to the Grey Market.

Panel A						
	< $0.01	[$0.01-$0.10)	[$0.10-$1.00)	[$1.00-$5.00)	≥ $5.00	Total
# OTC Penny	2,002	1,909	2,199	1,177	1,936	9,223
# Listed			63	611		674
Panel B						
Tier	< $0.01	[$0.01-$0.10)	[$0.10-$1.00)	[$1.00-$5.00)	≥ $5.00	
OTCQX	0.04%	2.49%	5.52%	3.24%	3.29%	
OTCQB	10.49%	22.63%	33.17%	31.58%	27.07%	
OTC Pink	66.71%	55.72%	42.22%	40.16%	35.50%	
Grey	22.76%	19.16%	19.09%	25.02%	34.14%	
Total	100%	100%	100%	100%	100%	

APPENDIX 2: SUMMARY STATISTICS

Table 2: **Summary Statistics**

This table provides summary statistics according to price and listing. *PNT* is the percentage of days of the sample period that a security does not trade. *# Trades* is the number of trades by day. For listed securities, this metric represents the number of trades on NASDAQ. *Spread %* is the difference in the closing bid-ask spread divided by the closing midpoint. *Volume* is total shares traded per day. $ Volume is daily dollar volume. For listed securities, it is calculated as closing price multiplied by volume. *Range %* is daily high price minus daily low price divided by the closing price. *Mkt Makers* is the number of market makers quoting a security. *Turnover* is daily volume divided by shares outstanding. *Market Cap* is price multiplied by shares outstanding and is reported in thousands. Each variable is found at the security level first and then averaged. Medians are reported in parentheses. All variables are trimmed at the 1% and 99% levels.

	OTC	OTC	OTC	OTC	OTC	Listed	Listed
	< $0.01	[$0.01-$0.10)	[$0.10-$1.00)	[$1.00-$5.00)	≥ $5.00	[$0.10-$1.00)	[$1.00-$5.00)
# Securities	2,002	1,909	2,199	1,177	1,936	63	611
PNT	59.25	58.94	52.49	57.11	61.55	1.01	2.06
	(69.43)	(70.57)	(58.49)	(67.92)	(69.43)	(0)	(0)
# Trades	9.08	7.19	8.44	8.08	4.48	1,097	1,375
	(2.73)	(2.58)	(3.18)	(2.63)	(2.14)	(412)	(367)
Spread %	51.37	46.25	32.21	17.80	7.64	2.23	1.50
	(43.40)	(36.90)	(18.82)	(6.05)	(2.45)	(2.00)	(1.04)
Volume	3,216,922	487,457	111,817	44,858	9,231	686,193	672,445
	(134,318)	(31,587)	(17,150)	(5,639)	(1,580)	(291,558)	(136,418)
$ Volume	6,267	7,345	17,658	34,465	59,111	500,507	2,224,325
	(302)	(1,117)	(4,802)	(11,183)	(27,708)	(185,125)	(348,271)
Range %	15.43	11.14	7.67	3.66	0.90	9.21	5.90
	(11.99)	(8.63)	(5.70)	(1.52)	(0.35)	(8.32)	(5.59)
# Mkt Makers	8.01	8.76	9.08	8.88	9.47	33	32
	(7.74)	(8.03)	(8.37)	(8.56)	(9.10)	(34)	(30)
Turnover	0.0059	0.0027	0.0013	0.0008	0.0005	10.65	9.80
	(0.0013)	(0.0006)	(0.0004)	(0.0001)	(<0.0001)	(5.77)	(4.87)
Mkt Cap (1000s)	1,094	11,479	275,686	1,695,422	4,740,820	53,925,255	169,509,864
	(206)	(2,023)	(13,782)	(88,447)	(954,000)	(32,339,502)	(63,584,711)

APPENDIX 3: DIFFERENCES IN LIQUIDITY AND MARKET QUALITY METRICS BY PRICE

Table 3: Differences in Liquidity and Market Quality Metrics by Price.

This table presents differences in averages for liquidity and market quality metrics of the securities in this study. *PNT* is the percentage of days with no trading. *# Trades* is the average number of trades per day. *Spread %* is the closing ask minus closing bid divided by midpoint. *Range* % is the average of the daily high price minus low price divided by the closing price. All variables are trimmed at the 1% and 99% levels.

Difference in Means													
	< $0.01	< $0.10	< $1.00	< $5.00	[$0.01-$5.00)	≥ $0.01	[$0.10-$5.00)	≥ $0.10	[$1.00-$5.00)	≥ $1.00	≥ $5.00	Diff	t-stat
PNT	59.25				55.85							3.40***	3.83
PNT	59.25					57.38						1.87**	2.23
PNT		59.10					54.10					5.00***	6.31
PNT		59.10						56.81				2.28***	3.27
PNT			56.72						57.11			-0.39	-0.36
PNT			56.72							59.87		-3.15***	-4.32
PNT				56.78							61.55	-4.77***	-5.64
# Trades	9.08				7.91							1.17***	2.80
# Trades	9.08					6.99						2.09***	5.54
# Trades		8.16					8.32					-0.16	-0.43
# Trades		8.16						6.91				1.24***	3.94
# Trades			8.26						8.08			0.18	0.35
# Trades			8.26							5.83		2.43***	7.37
# Trades				8.23							4.48	3.75***	9.86
Spread %	51.37				34.20							17.17***	16.95
Spread %	51.37					28.14						23.23***	24.63
Spread %		48.88					27.37					21.51***	24.24
Spread %		48.88						21.13				27.75***	36.00
Spread %			42.82						17.80			25.02***	20.19
Spread %			42.82							11.92		30.91***	37.35
Spread %				38.94							7.64	31.30***	30.44
Range %	15.43				8.02							7.41***	24.48
Range %	15.43					6.10						9.33***	34.57
Range %		13.32					6.26					7.05***	26.34
Range %		13.32						4.30				9.02***	41.25
Range %			11.27						3.66			7.61***	20.70
Range %			11.27							1.94		9.33***	40.92
Range %				10.02							0.90	9.13***	33.63

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 4: LIQUDITY REGRESSIONS

Table 4 Liquidity Regressions Panel A. This table presents the results of Tobit and OLS regressions for *PNT* on a host of control variables. *Range %* is the average of the daily high price minus low price divided by the closing price. *# Mkt Makers* is the average of the number of market makers that quote a security throughout the day. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *Pink* is a dummy variable equal to one if the security is designated to the OTC Pink Tier, zero otherwise. *OTCQB* is a dummy variable equal to one if the security is designated to the OTCQB Tier, zero otherwise. Regressions contain price level indicator variables. All variables are trimmed at the 1% and 99% levels.

$$PNT_i = \beta_1 Range\%_i + \beta_2 \#MktMakers_i + \beta_3 \log(MktCap)_i + \beta_4 SEC_i + \beta_5 Pink_i + \beta_6 OTCQB_i + \beta_7 Penny_i + \beta_8 Dime_i + \beta_9 Dollar_i + \beta_{10} Five_i + \varepsilon_i$$

	All (Tobit)	Pink (Tobit)	OTCQB (Tobit)	OTCQX (Tobit)	All (OLS)	Pink (OLS)	OTCQB (OLS)	OTCQX (OLS)
Range %	-1.0023***	-0.8783***	-1.1281***	-2.4071***	-0.8796***	-0.8097***	-0.7944***	-2.2888***
	(-16.871)	(-13.431)	(-9.748)	(-3.811)	(-17.287)	(-13.638)	(-9.144)	(-3.792)
# Mkt Makers	-5.8555***	-6.4926***	-5.6102***	-4.9738***	-5.0719***	-5.7471***	-4.7421***	-4.0114***
	(-54.319)	(-40.980)	(-35.392)	(-10.127)	(-55.224)	(-40.991)	(-35.164)	(-8.997)
Mkt Cap (log)	-2.6083***	-1.0855***	-3.1400***	-11.0516***	-2.2241***	-0.8973***	-2.5904***	-9.8584***
	(-16.301)	(-5.470)	(-7.896)	(-8.960)	(-14.710)	(-4.716)	(-7.133)	(-8.401)
SEC	-3.1396***	-0.4525	-4.9241***	5.1769	-3.3234***	-0.0682	-5.5252***	3.3667
	(-4.068)	(-0.447)	(-3.389)	(1.340)	(-4.743)	(-0.073)	(-4.362)	(0.946)
Pink	13.7535***				12.4900***			
	(8.823)				(8.612)			
OTCQB	16.7908***				15.4787***			
	(10.126)				(10.223)			
< $0.01	-20.7773***	-0.9842	-47.3454***		-17.4355***	-0.2200	-37.1508***	
	(-11.127)	(-0.419)	(-13.290)		(-10.240)	(-0.099)	(-13.049)	
[$0.01, $0.10)	-10.9827***	6.1336***	-21.8963***	-24.0551***	-9.2564***	6.4041***	-21.6464***	-17.2983**
	(-7.547)	(3.018)	(-9.379)	(-3.514)	(-6.892)	(3.308)	(-10.474)	(-2.587)
[$0.10, $1.00)	-11.5626***	1.7634	-17.5131***	-30.6652***	-9.8641***	2.4849	-17.2052***	-23.7962***
	(-9.453)	(0.989)	(-9.109)	(-5.844)	(-8.604)	(1.449)	(-9.891)	(-4.774)
[$1.00, $5.00)	-8.9318***	1.2962	-14.6409***	-32.3459***	-7.4707***	1.8532	-13.4962***	-25.9520***
	(-6.894)	(0.728)	(-7.474)	(-6.341)	(-6.080)	(1.076)	(-7.456)	(-5.614)
Constant	144.9972***	123.8015***	177.0844***	300.5390***	131.3672***	114.2218***	157.2599***	267.7784***
	(40.060)	(28.288)	(26.300)	(13.541)	(38.988)	(27.382)	(25.791)	(12.702)
Observations	5,886	3,510	2,091	285	5,886	3,510	2,091	285
R-squared					0.4637	0.4416	0.5349	0.6095

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

Table 4 Panel B. This table presents the results of Tobit regressions for *Spread%* on a host of control variables. *Range %* is the average of the daily high price minus low price divided by the closing price. *# Mkt Makers* is the average of the number of market makers that quote a security throughout the day. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *Pink* is a dummy variable equal to one if the security is designated to the OTC Pink Tier, zero otherwise. *OTCQB* is a dummy variable equal to one if the security is designated to the OTCQB Tier, zero otherwise. *#Trades* is the average number of trades per day. Regressions contain price level indicator variables. All variables are trimmed at the 1% and 99% levels.

$$Spread\%_i = \beta_1 Range\%_i + \beta_2 \#MktMakers_i + \beta_3 \log(MktCap)_i + \beta_4 SEC_i + \beta_5 Pink_i + \beta_6 OTCQB_i + \beta_7 Penny_i + \beta_8 Dime_i + \beta_9 Dollar_i + \beta_{10} Five_i + \beta_{11} \#Trades_i + \varepsilon_i$$

	All (Tobit)	Pink (Tobit)	OTCQB (Tobit)	OTCQX (Tobit)
Range %	0.6294***	0.6477***	0.7311***	0.3484*
	(15.227)	(13.028)	(9.590)	(1.739)
# Mkt Makers	-2.4730***	-2.5840***	-2.5845***	-1.1462***
	(-28.424)	(-19.533)	(-19.583)	(-6.299)
Mkt Cap (log)	-3.2773***	-3.5043***	-1.5902***	-3.9430***
	(-25.933)	(-20.765)	(-6.015)	(-5.025)
SEC	2.4634***	0.5875	2.6982***	1.8636
	(4.235)	(0.683)	(3.138)	(1.136)
Pink	8.0947***			
	(9.790)			
OTCQB	5.2357***			
	(6.020)			
<$0.01	-3.3049**	-1.7534	-8.3472***	
	(-2.469)	(-0.967)	(-4.003)	
[0.01, $0.10)	4.4628***	6.6515***	2.4077*	11.4223***
	(4.527)	(4.296)	(1.716)	(4.040)
[$0.10, $1.00)	3.4191***	1.9458	6.7603***	-2.1754
	(4.501)	(1.626)	(5.610)	(-1.097)
[$1.00, $5.00)	0.4716	-0.7726	2.6828**	-3.1873**
	(0.654)	(-0.784)	(2.321)	(-2.075)
# Trades	-0.1976***	-0.2895***	-0.1152***	-0.0039
	(-13.111)	(-10.926)	(-6.503)	(-0.156)
Constant	88.0675***	101.6250***	64.2585***	88.1148***
	(31.934)	(25.707)	(13.255)	(6.040)
Observations	5,816	3,446	2,086	284

APPENDIX 5: DIFFERENCES IN LIQUIDITY METRICS ACROSS TIERS

Table 5: Differences in Liquidity Metrics across Tiers

This table presents differences in means for liquidity and market quality metrics of the securities in this study during the sample period according to price and tier. *PNT* is the percentage of days with no trading. *# Trades* is the average number of trades per day. *Spread %* is the closing ask minus closing bid divided by midpoint. All variables are trimmed at the 1% and 99% levels.

Panel A: PNT	QX	QB	Pink	Difference	t-stat
[$0.01-$0.10)	56.19	34.36		21.83***	5.03
[$0.10-$1.00)	32.28	37.85		-5.57*	-1.90
[$1.00-$5.00)	20.13	45.87		-25.73***	-4.93
[$0.01-$0.10)	56.19		55.57	0.62	0.14
[$0.10-$1.00)	32.28		54.04	-21.77***	-7.49
[$1.00-$5.00)	20.13		55.83	-35.69***	-6.95
($0, $0.01)		16.41	52.03	-35.62***	-17.12
[$0.01-$0.10)		34.36	55.57	-21.21***	-12.65
[$0.10-$1.00)		37.85	54.04	-16.89***	-10.81
[$1.00-$5.00)		45.87	55.83	-9.96***	-4.60

Panel B: # Trades	QX	QB	Pink	Difference	t-stat
[$0.01-$0.10)	3.93	13.46		-9.53***	-3.45
[$0.10-$1.00)	13.17	13.80		-0.63	-0.32
[$1.00-$5.00)	27.83	10.86		16.97***	5.06
[$0.01-$0.10)	3.93		8.06	-4.12*	-1.82
[$0.10-$1.00)	13.17		6.84	6.32***	5.10
[$1.00-$5.00)	27.83		6.80	21.03***	8.55
($0, $0.01)		33.66	9.87	23.79***	15.77
[$0.01-$0.10)		13.46	8.06	5.40***	5.62
[$0.10-$1.00)		13.80	6.84	6.96***	8.33
[$1.00-$5.00)		10.86	6.80	4.05***	3.81

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

Panel C: Spread %	QX	QB	Pink	Difference	t-stat
[$0.01-$0.10)	33.48	31.73		1.75	0.45
[$0.10-$1.00)	12.13	30.60		-18.47***	-6.95
[$1.00-$5.00)	4.35	21.92		-17.58***	-4.28
[$0.01-$0.10)	33.48		50.52	-17.04***	-3.55
[$0.10-$1.00)	12.13		38.49	-26.26***	-7.85
[$1.00-$5.00)	4.35		18.64	-14.29***	-3.15
($0, $0.01)		24.76	52.02	-27.26***	-12.74
[$0.01-$0.10)		31.73	50.52	-18.79***	-10.49
[$0.10-$1.00)		30.60	38.49	-7.89***	-4.71
[$1.00-$5.00)		21.92	18.64	3.28*	1.75

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 6: PRICE REGRESSIONS

Table 6: Price Regressions Panel A This table presents the results of Tobit regressions for *PNT* (Panel A) and *Spread %* (Panel B) on a host of control variables. Individual regressions are run according to price. *PNT* is the percentage of days during the sample period that a firm does not trade. Spread *%* (the closing ask minus closing bid divided by midpoint) is the dependent variable in the last four models. *Range %* is the average of the daily high price minus low price divided by the closing price. *# Mkt Makers* is the average of the number of market makers that quote a security throughout the day. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *Pink* is a dummy variable equal to one if the security is designated to the OTC Pink Tier, zero otherwise. *OTCQB* is a dummy variable equal to one if the security is designated to the OTCQB Tier, zero otherwise. Regressions contain price level indicator variables. All variables are trimmed at the 1% and 99% levels.

$$PNT_i \text{ or } Spread\%_i = \beta_1 Range\%_i + \beta_2 \#MktMakers_i + \beta_3 \log(MktCap)_i + \beta_4 SEC_i + \beta_5 Pink_i + \beta_6 OTCQB_i + \beta_7 Penny_i + \beta_8 Dime_i + \beta_9 Dollar_i + \beta_{10} Five_i + \beta_{11} \#Trades_i + \varepsilon_i$$

	< $5.00	($0, $0.01)	[$0.01-$0.10)	[$0.10-$1.00)	[$1.00-$5.00)
Range %	-0.9107***	-0.9084***	-0.9541***	-0.5843***	-1.7385***
	(-16.009)	(-12.094)	(-9.757)	(-4.471)	(-5.766)
# Mkt Makers	-6.5060***	-6.3611***	-6.3400***	-6.4721***	-6.7026***
	(-54.977)	(-18.513)	(-27.415)	(-35.231)	(-24.841)
Mkt Cap (log)	-1.5440***	-2.3833***	-1.7651***	-0.9756***	-0.8479**
	(-8.273)	(-5.104)	(-4.345)	(-2.755)	(-2.177)
SEC	-0.1573	1.1485	-2.1992	-1.7829	0.2796
	(-0.185)	(0.841)	(-1.405)	(-1.024)	(0.103)
Pink	18.3591***	18.6861***	7.5721***	17.8635***	26.0449***
	(11.577)	(8.603)	(2.982)	(8.270)	(6.175)
OTCQB	18.0972***		5.7097*	22.0310***	36.0663***
	(10.545)		(1.951)	(8.950)	(7.579)
[$0.01, $0.10)	9.4832***				
	(9.094)				
[$0.10, $1.00)	7.9790***				
	(6.162)				
[$1.00, $5.00)	8.7419***				
	(5.146)				
# Trades					
Constant	109.0642***	119.8982***	132.7686***	103.7636***	98.3461***
	(34.275)	(20.652)	(20.509)	(16.151)	(10.870)
Observations	4,825	1,135	1,254	1,640	796

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

Table 6: Panel B This table presents the results of Tobit regressions for *PNT* (Panel A) and *Spread %* (Panel B) on a host of control variables. Individual regressions are run according to price. *PNT* is the percentage of days during the sample period that a firm does not trade. Spread *%* (the closing ask minus closing bid divided by midpoint) is the dependent variable in the last four models. *Range %* is the average of the daily high price minus low price divided by the closing price. *# Mkt Makers* is the average of the number of market makers that quote a security throughout the day. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *Pink* is a dummy variable equal to one if the security is designated to the OTC Pink Tier, zero otherwise. *OTCQB* is a dummy variable equal to one if the security is designated to the OTCQB Tier, zero otherwise. Regressions contain price level indicator variables. All variables are trimmed at the 1% and 99% levels.

$$PNT_i \text{ or } Spread\%_i = \beta_1 Range\%_i + \beta_2 \#MktMakers_i + \beta_3 \log(MktCap)_i + \beta_4 SEC_i + \beta_5 Pink_i + \beta_6 OTCQB_i + \beta_7 Penny_i + \beta_8 Dime_i + \beta_9 Dollar_i + \beta_{10} Five_i + \beta_{11} \#Trades_i + \varepsilon_i$$

	< $5.00	($0, $0.01)	[$0.01-$0.10)	[$0.10-$1.00)	[$1.00-$5.00)
Range %	0.6114***	0.4496***	0.3963***	1.0817***	1.0280***
	(14.571)	(8.646)	(4.596)	(10.964)	(2.813)
# Mkt Makers	-2.7491***	-3.6597***	-3.5012***	-2.3557***	-2.3578***
	(-27.308)	(-12.453)	(-18.120)	(-13.689)	(-10.505)
Mkt Cap (log)	-3.5755***	-2.3711***	-2.9788***	-3.8108***	-2.0256***
	(-22.681)	(-5.944)	(-7.714)	(-11.734)	(-6.078)
SEC	2.1151***	-0.5889	-0.6801	3.3922**	6.3903***
	(3.227)	(-0.515)	(-0.561)	(2.419)	(3.525)
Pink	9.8929***	7.4822***	9.3626***	10.2030***	5.2044***
	(10.631)	(5.725)	(4.155)	(10.173)	(3.394)
OTCQB	7.4673***		4.9677**	8.8378***	5.8533***
	(7.315)		(2.050)	(6.469)	(3.204)
[$0.01, $0.10)	8.3602***				
	(9.499)				
[$0.10, $1.00)	7.7543***				
	(7.199)				
[$1.00, $5.00)	5.0349***				
	(3.792)				
# Trades	-0.1856***	-0.1899***	-0.1729***	-0.1492***	-0.0965***
	(-11.490)	(-8.403)	(-5.133)	(-4.498)	(-2.684)
Constant	89.7352***	90.4006***	101.9562***	91.5430***	61.3098***
	(34.087)	(18.172)	(15.425)	(15.752)	(8.258)
Observations	4,820	1,134	1,253	1,637	796

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 7: DIFFERNCES IN LIQUIDITY METRICS BETWEEN LISTED SECURITIES AND OTC SECURITIES

Table 7: Differences in Liquidity Metrics between Listed Securities and OTC Securities

This table presents differences in means for liquidity and market quality metrics of the securities in this study according to listing status and price. *PNT* is the percentage of days with no trading. *# Trades* is the average number of trades per day. For listed securities, *# Trades* represents the number of trades on NASDAQ. *Spread %* is the closing ask minus closing bid divided by midpoint. *Range %* is the average of the daily high price minus low price divided by the closing price. All variables are trimmed at the 1% and 99% levels.

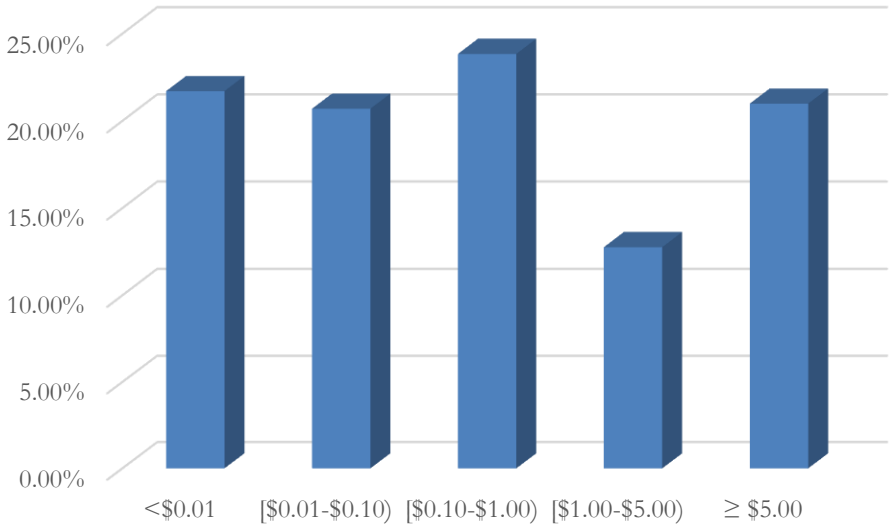
	Listed	OTC	Difference	t-stat
PNT (<$5.00)	1.96	56.78	-54.82***	-41.95
PNT [$0.10-$1.00)	1.01	52.49	-51.48***	-11.87
PNT [$1.00-$5.00)	2.06	57.11	-55.04***	-39.38
# Trades (<$5.00)	1358.10	8.23	1349.9***	31.72
# Trades [$0.10-$1.00)	1097.30	8.44	1088.9***	29.13
# Trades [$1.00-$5.00)	1374.90	8.08	1366.8***	12.57
Spread % (<$5.00)	1.57	38.94	-37.37***	-27.35
Spread % [$0.10-$1.00)	2.23	32.21	-29.97***	-6.75
Spread % [$1.00-$5.00)	1.50	17.80	-16.31***	-14.94
Range % (<$5.00)	6.21	10.02	-3.81***	-8.33
Range % [$0.10-$1.00)	9.21	7.67	1.54	1.36
Range % [$1.00-$5.00)	5.90	3.67	2.24***	9.10

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 8: OTC STOCKS BY PRICE

Figure 1: OTC Stocks by Price

This figure categorizes the full sample of OTC stocks according to price.



APPENDIX 9: OTC FIRMS BY PRICE AND TIER

Figure 2: OTC Firms by Price and Tier

These figures categorize firms within each tier according to price. Figure 2a describes OTCQX firms. Figure 2b categorizes OTCQB firms. Figure 2c classifies OTC Pink Firms. Lastly, Figure 2d classifies Grey Firms.

Figure 2a

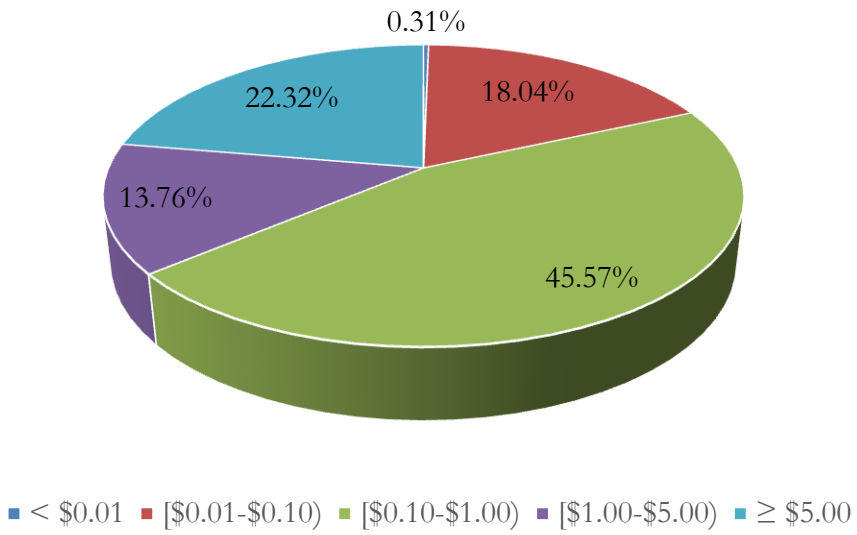


Figure 2b

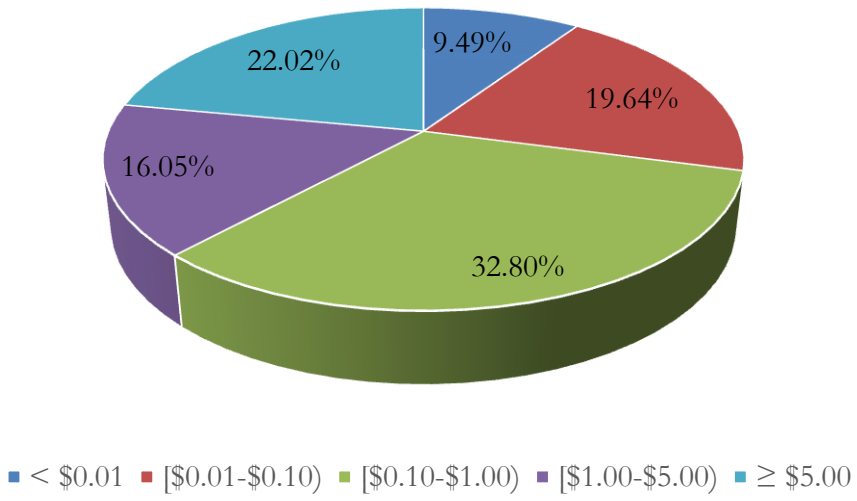


Figure 2c

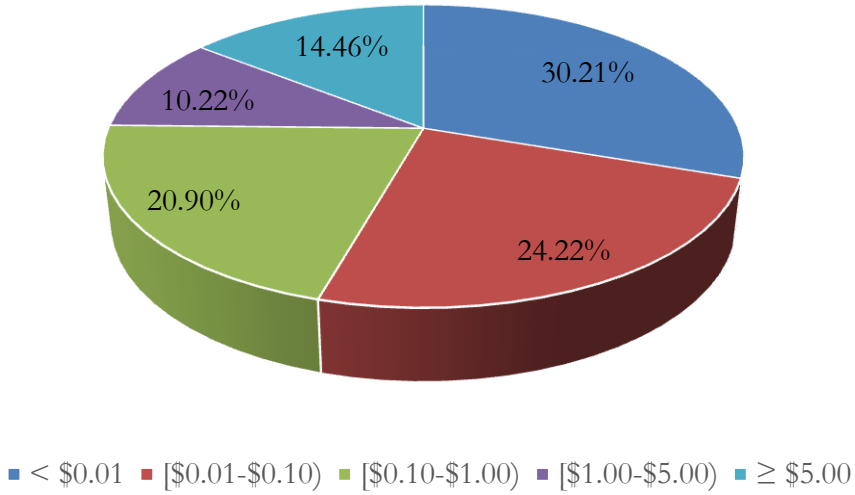
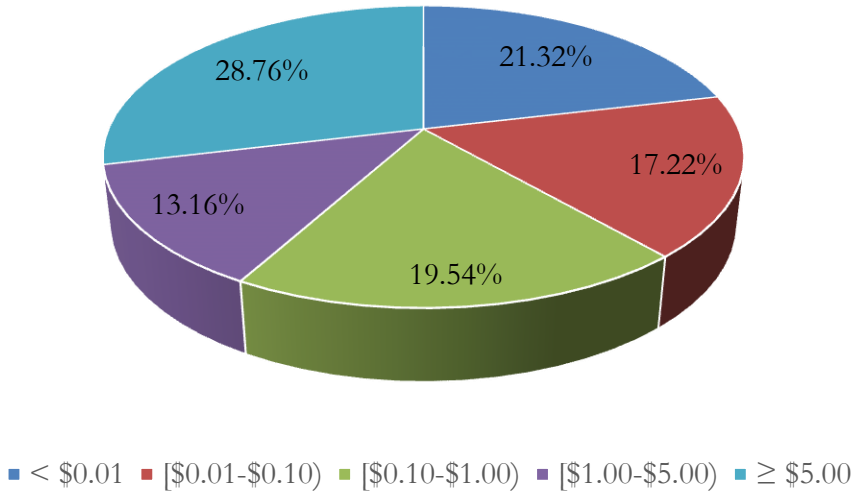


Figure 2d



PART 3: RISK, UNCERTAINTY, AND DIVERGENCE OF OPINION: SHORT SELLING IN THE OTC MARKET

PART 3

INTRODUCTION

In contrast to their listed peers, OTC securities are more illiquid, have minimal disclosure requirements, and are primarily held by noninstituional (i.e. retail) investors (Ang, Shatauber, and Tetlock, 2013; hereafter, AST). Since institutions are typically the primary lenders of shares, short selling in the OTC market is "difficult, expensive, and rare." Nagel (2005) uses institutional ownership as a proxy for short sales and finds that when institutional ownership is low, stock available for shorting is extremely limited and short selling more expensive. Shorting difficulties also arise because brokerages may not allow investors to short sell OTC stocks at all, or if they do, may levy additional restrictions on investors including a minimum price threshold (typically one dollar) or add additional margin constraints (Eraker and Ready, 2014). Even without these constraints, shares of OTC securities are often not available to short. Eraker and Ready suspect the difficulty shorting OTC stocks is one possible explanation for negative average OTC stock returns. AST also document negative OTC stock returns resulting from behavioral biases and limits to arbitrage. The negative returns are driven by stocks with higher levels of investor disagreement. Restrictions on short selling can lead to such overpriced securities that stocks with low systematic risk may have higher returns than stocks with higher

systematic risk. AST and Eraker and Ready conclude that OTC stocks are assets with lottery-like payoffs, and Nofinsger and Varma (2014) find that OTC investors have preferences for lottery-like stocks. Short selling difficulties in the OTC marketplace not only contribute to the large negative returns of OTC stocks, but also add to the lottery-like characteristics of these securities (Eraker and Ready). Bruggemann, Kaul, Leuz, and Werner (2013) state that if the OTC market consists of retail investors seeking lottery-like payoffs, then together with restrictions on short selling, sophisticated investors may not be willing to participate in the market.

In this paper, my purpose is twofold. First, I study the relation between short interest and the lottery characteristics (i.e. prices, volatility, and returns) of OTC securities. Eraker and Ready (2015) suggest short selling difficulties add to the lottery-like characteristics of OTC securities. It is an open empirical question, however, as to the relation between short interest and stock and firm characteristics, in particular lottery characteristics. Also, given that OTC investors are primarily concerned about stock liquidity, which in the OTC market includes the ability to trade a stock at all (Ang, Shtauber, and Tetlock, 2013), I also examine the relation between short selling and liquidity determinants.

Second, the new OTC information tier designations of the securities in this study provide a unique setting to examine the effects of information disclosure on short selling in the OTC market. In an effort to improve transparency in this market, OTC Markets Group currently organizes firms trading OTC into one of three tiers (OTCQX, OTCQB, and OTC Pink) based on the quantity and quality of information firms make available. Firms designated to either of the top tiers, OTCQX or OTCQB, are required to meet certain financial and disclosure standards. While OTCQX and OTCQB firms must be current in their reporting, OTC Pink firms have variable reporting standards and are either unable or unwilling to provide adequate information

and transparency. I examine the relation between tier designation and short interest. Information disclosure allows shareholders and creditors to evaluate potential returns and monitor the use of capital (Beyer, Cohen, Lys, and Walther, 2010). Therfore, greater transparency resolves uncertainty and reduces information asymmetry and divergence of opinion (Ang, Shatuaber, and Tetlock, 2013). As a result, I expect to find firms in higher information tiers to have less short interest.

While financial transparency may alleviate price discrepancies among OTC investors, OTC firms may have "private incentives to… withhold or manipulate information in certain situations, e.g. when performance is poor" (Bushee and Leuz, 2005). As a result, OTC stocks are inherently risky and difficult to price because they trade infrequently, have variable reporting standards, and provide very little information to investors. OTC firms are notorious for their information asymmetry and based on their price, volatility, and illiquidity levels, are subject to deception, manipulation, fraud, and most recently to "pump and dump" spam campaigns (see, for example, Bollen and Christie, 2009, and Hu, McInish, and Zeng, 2010).

My results indicate that larger, more liquid stocks, and securities of firms registered with the SEC, are easier to short. While short interest is directly related to lottery characteristics like price and liquidity, I find no relation between short interest and daily price volatility. I also find that firms in higher information tiers have less short interest than firms in lower information tiers. This result is in line with AST (2013) who suggest that information disclosure reduces divergence of opinion. Additionally, although ADRs trading in the OTC market have larger institutional participation than common stocks or ordinary shares (Jiang, Petroni, and Wang, 2013), ADRs tend to have less short interest than other security types. I also study the daily return performances of securities with differing levels of short interest to determine if the

performance of OTC securities behaves as predicted by a theoretical model provided by Ang, Shtauber, and Tetlock (2013). Lastly, I find that firms with higher levels of short interest have more positive return days than firms with less short interest. Overall, my results provide support for studies suggesting that the difficulty shorting OTC stocks adds to the lottery-like features of these securities. My results also support Bollen and Christie's (2009) claim that the OTC market is the wild, wild west of securities trading.

My results are in line with theoretical papers such as Miller (1977) and Diamond and Verrecchia (1987), who suggest that restrictions on short selling activity, coupled with higher levels investor disagreement, inhibit negative information from being incorporated into stock prices. When shorting is difficult, disproportionate weight is given to optimistic return forecasts, which leads to widespread overpricing (Figlewski, 1981). Empirical studies of listed securities support these conjectures. Boehmer, Jones, and Zhang (2008), Diether, Lee, and Werner (2009), and Boehmer and Wu (2013) find that short-selling arbitrage activity contributes to efficient market pricing, keeping security prices in line with their true value.

LITERATURE REVIEW

Studies of OTC securities comment on the difficulties shorting OTC stocks (see for example, AST, 2013; Eraker and Ready, 2013; Bruggemann, Kaul, Leuz, and Werner, 2013; and Angel, Harris, Pauchapogesan, and Werner, 2004). Few studies explore the topic further. AST study OTC securities priced over one dollar and find that relative to listed stocks, OTC stocks have less intuitional investors, are more illiquid, and disclose less information. While the size, value, and volatility return premiums are similar to listed markets, the OTC market has an illiquidity (momentum) premium that is higher (lower) than in listed markets. Additionally, AST state that OTC traders are primarily retail investors who may not pay attention to firms' fundamentals. AST document negative OTC stock returns resulting from behavioral biases and limits to arbitrage, and note that this negative performance is driven by stocks with higher levels of investor disagreement.

In a subsample of 50 OTC stocks and 50 listed securities, AST (2013) find that average short interest as a percentage of floating shares for OTC (listed) securities is 0.5% (4.1%) and is higher than 0.1% for 44% (100%) of their sample. However, they find that a retail trader could only short one of the 50 OTC stocks in their sample, and suggest that limits to short selling extend to the entire OTC market. AST argue that the higher proportions of retail investors may lead to greater disagreement on prices, which as a result, create pervasive overpricing in the OTC market. The authors provide an OTC pricing model that shows that the costs of short selling discourage pessimistic investor participation. Higher levels of overconfidence produce widespread overpricing, which results in negative risk adjusted returns. AST suggest that firms

with less financial disclosure have greater levels of investor disagreement and overpricing. Disclosure of financial information resolves uncertainty and reduces divergence of opinion among overconfident investors.

Eraker and Ready (2014) find that the distribution of OTC stock returns is positively skewed. While most OTC stocks have negative average returns, some perform well. Eraker and Ready attribute this negative return premium to investors' preference for positively skewed lottery-like assets. Eraker and Ready suspect the difficulty in shorting OTC stocks adds to the average negative returns they document, but state that the return performance of OTC stocks might also result from investor preferences for lottery-like assets. Bruggemann, Kaul, Leuz, and Werner (2013) find that OTC investors pay attention to information differences across firms and venues and transact accordingly. They conclude that OTC firms tend to be small penny stocks with negative average returns and high return volatility (i.e. assets with lottery-like payoffs). However, they do not find return differences between the OTC information tiers and explain their results through retail investor preferences for lottery-like assets and short-sale constraints. They argue that such restrictions may lead sophisticated investors to withdraw from the market, which may make it more difficult to price securities and in turn find return differences between the different information tiers. Bruggemann, Kaul, Leuz, and Werner believe the lower market quality they document is a result of low investor participation.

There is a substantial body of literature that examines short-selling in listed securities. In a seminal piece, Miller (1977) suggests that short-sale constraints prevent investors with negative information from participating in the market. Consequently, a disproportionate weight is given to optimistic return forecasts, which leads to widespread overpricing (Figlewski, 1981). Diamond and Verrecchia (1987) show restrictions on short selling reduce pricing efficiency as stocks

adjust to positive news much quicker than they do negative news. Unlike Miller (1977), however, they state that rational investors will expect a reduction in pricing efficiency and modify valuations accordingly so that no overpricing exists. Hong and Stein (2003) hypothesize that when investors have divergent opinions, short-sale constraints can lead to inflated stock prices followed by crashes. Chang, Cheng, and Yu (2007) posit that greater divergence of opinion leads to a more overvalued stock price.

Empirical studies of listed securities support some of these theories. Boehmer, Jones, and Zhang (2008), Diether, Lee, and Werner (2009), and Boehmer and Wu (2013) find that short-selling arbitrage activity keeps prices in line with their true value and contributes to efficient stock prices by correcting pricing errors. Cohen, Diether, and Malloy (2007), along with Boehmer and Wu find that short sellers contribute to price discovery. Since short sellers are informed traders (Boehmer, Jones, and Zhang; Christophe, Ferri, and Hsieh, 2010; Karpoff and Lou, 2010; and Engleberg, Reed, and Riggenberg, 2012), restrictions to their activity reduce market efficiency. Edwards and Hanley (2010) find that short selling does not lead to elevated levels of IPO underpricing, but is instead an integral part to aftermarket trading. Restrictions on short selling may have unexpected consequences as well. Battalio and Schultz (2011) find that the 2008 short sale ban affected the derivatives market as seen in increased trading costs of options and the decoupling of option and stock prices.

Boehmer, Huszer, and Jordan (2010) look at stocks with lower levels of short interest and find that they outperform stocks heavily shorted. Returns to the portfolio of lightly shorted stocks is greater in absolute value than returns to the portfolio of heavily shorted stocks. Their results indicate that short sellers avoid undervalued securities and sell overvalued securities.

Critics of short selling state that these traders create negativity and add downward pressure to stock prices. Blau, Van Ness, Van Ness, and Wood (2010) find elevated (suppressed) levels of short-selling on days when the market is down (up), while Brunnermeir and Pedersen (2005) suggest that short sellers can prey on other investors. Shikilko, Van Ness, and Van Ness (2012) study periods with downward price pressures in individual stocks and find that short sellers exacerbate price declines. However, they find no short selling abuses, and in particular, that liquidity-demanding non-short volume primarily drives price declines. Likewise, Jain, Jain, and McInish (2012) do not find elevated levels of short selling on days with extreme downward movements around their study of SEC Rule 201. Diether, Lee, and Werner (2009) study the suspension of the short-sale price test as part of the REG SHO Pilot program and find that short sales as a fraction of share volume increases. They find no evidence of an increase in excess downside volatility or a decrease in returns around the REG SHO implementation.

DATA

Data in this study is provided by OTC Markets Group and covers all trading days beginning February 18th, 2014, and ending March 6th, 2015. The data contains comprehensive end-of-day/closing trading and quoting information. The files are similar to CRSP files, but supply information specific to OTC firms including tier designation, third-party sponsors, and a caveat emptor flag. OTC Markets Group identifies securities within each tier that are subject to a stock spam campaign, fraud or criminal investigation, undisclosed corporate actions (e.g. reverse merger, stock split, name change), or a trading suspension/halt (among other reasons) with a Caveat Emptor (i.e. buyer beware) flag. Investors are encouraged to exercise additional caution and perform a thorough examination of securities with this flag before investing. OTC Markets Group also provide a security data file for February 18th, 2014, and March 6th, 2015, which contains shares outstanding.

Recent studies of the OTC market apply nontrivial restrictions on their sample, thereby removing some of the important variation in this marketplace. For example, Eraker and Ready (2015) exclude non-US stocks, ADRs, and securities priced under $0.01. Bruggemann, Kaul, Luez, and Werner (2013) exclude firms incorporated outside the US. Ang, Shtauber, and Tetlock (2013) require stocks to trade over $1.00 and have a market cap of at least $1 million. In contrast, I consider all domestic and international securities alike, without restrictions on firm size. To be included in my sample I require a firm to trade at least ten times and report shares outstanding. Due to the time period of my sample, the nature of the firms in the sample, and the bi-monthly reporting of short interest, I remove any firms that do not report short interest in 2013

or later. Because I study the effects of tier designation on short selling, I require firms to remain in the same information tier throughout the sample period. I consider all common stock, ordinary shares, or American Depository Receipts (ADRs), without additional restrictions on type or size. Ordinary shares are common stock of international firms. ADRs are issued by a U.S. depository bank and provide investors the opportunity to own and trade international securities in U.S. dollars during normal U.S. trading hours. ADRs tend to be larger OTC securities and have more institutional ownership than non ADRs (Jiang, Petroni, and Wang, 2013). Lastly, I trim the sample at the 1% level to remove the impact of outliers and possible data errors.

There are a wide variety of global securities trading in the OTC marketplace, some of which are highly illiquid and trade infrequently during my sample period. In Panel A of Table 1, I classify the sample of firms according to security type and tier designation. I study over 8,000 OTC securities including more than 4,000 common stocks, 3,000 ordinary shares and 1,000 ADRs. The largest portion of my sample trade in the OTC Pink tier. Overall, the firms in the sample are extremely illiquid. As seen in Panel B, these securities trade every other day (*PNT* of 49.96) and only trade an average of 11.23 times per day on the days when they trade. While the average price of the securities in the sample is $8.59, the median price is under one dollar ($0.67). As mentioned previously, OTC securities are extremely difficult to short, in part due to the lack of shares available for shorting. The average amount of shares available to short is less than one percent of the available shares outstanding.

HYPOTHESES AND RESULTS

Kumar (2009) identifies low-priced stocks with high idiosyncratic volatility and high idiosyncratic skewness as lotteries, and suggests that individual investors have preferences for stocks with lottery-like characteristics. Eraker and Ready (2015) also argue that some investors might have preferences for stocks with lottery features and are thus willing to accept negative returns for securities with lottery features. Eraker and Ready hypothesize that short selling difficulties in the OTC market not only contribute to the large negative returns of OTC stocks, but also add to the lottery-like features of these securities. It is an open empirical question, however, as to the relation between short interest and stock and firm characteristics, in particular the relation between short selling in the OTC market and the lottery characteristics of these securities. Also, given that OTC investors are primarily concerned about stock liquidity, which in the OTC market includes the ability to trade a stock at all (Ang, Shtauber, and Tetlock, 2013), it is important to examine the relation between short selling and liquidity determinants.

AST (2013) proxy investor disagreement using illiquidity, size, return volatility, and value premiums to proxy for investor disagreement. Their model predicts greater overpricing and differences in opinion with higher levels of trading volume, return volatility, firm size, and market-to-book ratio. AST assume that it is more difficult for retail investors to short small stocks. They find that negative OTC stock returns are driven by stocks with the most trading activity (implying elevated levels of investor disagreement). On the other hand, Diether, Lee,

and Werner (2009) study the suspension of the short-sale price test as part of the REG SHO Pilot program and find that short sales as a fraction of share volume increases. However, they find no evidence of an increase in excess downside volatility or a decrease in returns around the REG SHO implementation. Given these findings above, I offer the following two hypotheses.

Hypothesis 1: Stocks with higher levels of volatility will have more short interest than firms with lower levels of volatility.

Hypothesis 2: Stocks that trade more frequently (trade on more days) will have higher levels of short interest than firms that trade less frequently.

To address Hypothesis 1 (Hypothesis 2), I compare short interest between firms within differing volatility and illiquidity quartiles. I first sort firms based on average daily volatility (illiquidity) over the sample period. I then compare the amount of short interest between firms in the highest volatility (illiquidity) quartile to firms in the lowest volatility (illiquidity) quartile. I define volatility as a firm's daily price range expressed as a percentage of its closing price. I measure illiquidity with *PNT*, the percentage of days during the sample period that a firm does not trade. *PNT* is used by AST (2013) and Bruggemann, Kaul, Leuz, and Werner (2013) in their analyses of OTC securities. Results in Panel B of Table 2 suggest that securities experiencing greater daily price volatility (as defined by daily price range expressed as a percent of the closing price) have less short interest than firms with less price volatility. This goes against what is proposed in Hypothesis 1. Regarding illiquidity, I find no difference in short interest based on *PNT* quartiles. The most illiquid firms, as represented by *PNT*, have levels of short interest that are the same as the most liquid firms. The differences in means, as seen in both *PNT* quartiles and *# Trades* quartiles, are not statistically different from zero. These results are also in contrast to that proposed in Hypothesis 2.

Nofsinger and Varma (2014) use the one dollar price threshold to identify lottery stocks in the OTC market. Eraker and Ready (2014) state that many brokerages do not allow short selling in stocks priced below one dollar. Since many penny stocks are priced below one dollar (Davis, 2015), practically worthless, I expect less divergence of opinion for OTC penny stocks. Additionally, Miller (1977) argues that "the riskiest stocks are also those about which there is the greatest divergence of opinion." Consequently, I propose Hypothesis 3 below.

Hypothesis 3: Stocks priced over one dollar will be easier to short (i.e. have more short interest) than stocks priced under one dollar.

I compare short interest for firms above or below the $1.00 penny stock threshold. Results in Panel C of Table 2 suggest that lower priced firms have less short interest than higher priced firms. In particular, I use both a one dollar and a five dollar price threshold as a penny stock indicator. Using either classification, I find that higher priced OTC securities have more short interest than penny stocks, as predicted in Hypothesis 3.

I address Hypothesis 1, Hypothesis 2, and Hypothesis 3 in a multivariate setting as well by examining the relation between *Short Interest* and these firm and security characteristics. Since I am specifically interested in studying the relation between short interest and the lottery features of these securities, I include price, and volatility, and liquidity determinants previously documented for listed securities. Chordia, Roll, and Subrahmanyam (2000) document common liquidity determinants that include volatility, volume, and price. For my analysis, I include *PNT* and *# Trades* (as an activity proxies), *Price*, firm size (*Mkt Cap)*, and *Range* (as a risk proxiy). Since firms registered with the SEC are required to disclose important financial information, I include an SEC dummy variable (as an information proxy). *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. I average each independent variable at

the daily level and regress *Short Interest* on these firm and security characteristics. Since the dependent variable is bounded between 0 and 1, I present results for Tobit analyses in Table 3. All variables are trimmed at the 1% and 99% levels to remove the impact of outliers and possible data errors.

As seen in equation (1) of Table 3, the negative (positive) coefficient on *PNT* (*# Trades)* suggests that firms that trade more often tend to have more short interest. The signs of the coefficients are in line with Hypothesis 2. While neither *Price* nor *Range* are significant predictors of *Short Interest*, as seen in equation (1), I find that larger firms and firms registered with the SEC have higher levels of short interest, as seen in the positive coefficients on *Mkt Cap* and *SEC*, respectively. The lack of significance on price and volatility, in contrast to Hypothesis 1 and Hypothesis 3, is surprising given the previous literature's assumption that short interest is related to the lottery features of OTC securities.

Nofsinger and Varma suggest that OTC securities priced below one dollar are lottery stocks, as defined by Kumar (2009). To address Hypothesis 3 in a multivariate setting, I include a price indicator variable equal to one if a security has an average price below one dollar, and zero otherwise. As reported in equation (2) of Table 3, the coefficient of *<$1.00* indicates that penny stocks (as defined by Nofsinger and Varma) priced below one dollar are more difficult to short than firms priced over one dollar. Additionally, I find (weak) significance on *Range*, suggesting that firms with greater volatility have higher levels of short interest. In total, I find support for Hypothesis 2 and Hypothesis 3, but only mild support for Hypothesis 1.

In Figure 1, I report short interest as a percentage of shares outstanding, by firm price. Firms priced above one dollar have short interest levels similar to what is reported by AST (2013) for their subsample of 50 OTC firms. Firms in the price partitions below one dollar have

short interest percentage values ranging from 0.06% (as seen in the group priced between $0.01 and $0.10) to 0.15% (as seen in the group priced between the $0.10-$1.00 group). While all of the levels reported in Figure 1 are low relative to listed securities (see AST, 2013), it is worth noting that shares are actually available for shorting even in the lowest priced OTC securities. Divergence of opinion, as evidenced by the presence of short interest, exists even in securities that are almost practically worthless (i.e. penny stocks trading in subpenny increments near $0.00).

SHORT INTEREST AND ADRS

The next portion of my empirical analysis examines the relation between short interest and security type. AST (2013) argue that investor disagreement is higher in the OTC market than listed markets due to lower disclosure requirements and higher proportions of retail investors. AST also state that institutions hold 26% of OTC stocks and 71% of comparable listed stocks. Nagel (2005) uses institutional ownership as a proxy for short sales and finds that when institutional ownership is low, stock available for shorting is limited and shorting is more expensive. While institutions are the primary lenders of shares (AST, 2013), many professional investors never sell short (Nagel, 2005). AST (2013) show that the return premiums for illiquidity, volatility, value and size are larger in OTC stocks that are not held by institutions. Because (i) Jiang, Petroni, and Wang (2013) state that American Depository Receipts (ADRs) tend to be larger OTC securities that have more institutional ownership than non ADRs, and (ii) OTC ADRs are similar to listed securities (Bollen and Christie, 2009), I predict the following in Hypothesis 4 below.

Hypothesis 4: Shares of OTC ADRs will have higher levels of short interest relative to common stock and ordinary shares (i.e. common stock of foreign companies).

As seen in Panel A of Table 4, I find that ADRs have less short interest than non-ADRs. This result is in contrast to Hypothesis 4 above. This outcome is unexpected given that ADRs most closely resemble listed securities, in addition to the fact that ADRs typically display higher levels of institutional ownership. This result is, however, in line with Nagel (2005) who states

that many professional investors may never sell short. These results may also suggest that stocks with greater institutional participation (and less short interest) are priced more efficiently. Consequently, the absence of short interest in this situation, indicating less divergence of opinion among investors, could be good news for future stock returns (Boehmer, Huszer, and Jordan, 2010).

I next include *ADR* to the multivariate setting presented in Table 3. *ADR* is an indicator variable equal to one if the security is an American Depository Receipt, zero otherwise. The negative coefficient of *ADR*, as reported in Panel B of Table 4, indicates that ADRs have lower levels of short interest relative to common stock and ordinary shares. This sign agrees with the univariate results in Panel A and is, again, opposite the proposed direction in Hypothesis 4. All of the remaining coefficients have the same sign as in previous specifications, except for *SEC*. After including *ADR*, the positive coefficient on *SEC* disappears indicating that there are no significant differences in short interest between firms registered with the SEC relative to firms that are not registered with the SEC. *ADR* turns out not only to be highly significant, but an important control variable in future specifications.

SHORT INTEREST BY TIER

In Appendix A of their paper, AST (2013) provide an OTC pricing model that shows the costs of short selling discourage pessimistic investor participation. Higher levels of overconfidence produce widespread overpricing, which results in negative risk adjusted returns. AST suggest that firms with less financial disclosure will have greater levels of investor disagreement and overpricing. However, disclosure of financial information resolves uncertainty and reduces the difference in opinion of overconfident investors. Their model predicts greater overpricing and differences in opinion with higher levels of trading volume, return volatility, firm size, and market-to-book ratio. These relations are even stronger for stocks with greater investor overconfidence and those with less financial disclosure. Assuming that greater transparency and financial disclosure resolves uncertainty and reduces information asymmetry and divergence of opinion (Ang, Shatuaber, and Tetlock, 2013), then I expect Hypothesis 5 below to hold.

Hypothesis 5: Firms in higher information tiers will have less short interest than firms in lower information tiers.

To test Hypothesis 5, I first calculate the difference in means of short interest for firms by tier designation. Recall, firms in the highest information tier, OTCQX, meet the highest possible financial and transparency standards required by the OTC Markets Group. OTCQB firms must also provide financial disclosure, but fail to meet all of the conditions of the top information tier designation. OTC Pink firms, on the other hand, are not subject to any minimum financial or reporting requirements. Firms that do not quote trade in the Grey Market. The results of this analysis, reported in Table 5, indicate that firms in the highest information tiers (OTCQX and

OTCQB) have less short interest than firms in either the Pink tier or the Grey Market. I find no statistical significance between short interest between the top two tiers (OTCQX versus OTCQB) or the bottom designations (OTC Pink versus Grey Market). These non-results for differences between the top two tiers (and bottom two tiers) should not be surprising. While both OTCQX and OTCQB firms must be current in their reporting, many OTCQB firms do not qualify for the top tier simply because they do not pass a minimum bid price test of $0.10. Similarly, neither OTC Pink nor Grey Market firms have no financial or disclosure requirements.

To obtain a better understanding of the relation between short interest and information, I examine Hypothesis 5 in a multivariate setting as well. I perform a similar analysis as in Table 3 and Table 4, but this time add information tier designation dummy variables indicating a firm's trading venue. Since many firms change tiers during the sample period, I only analyze firms that remain in the same tier for the entire sample period. This provides the cleanest look at the relation between short interest and tier designation. Results of this regression analysis are reported in Table 6. All of the tier dummy variables are significant. The coefficient of OTCQB is negative suggesting that OTCQB firms have less short interest than OTCQX firms (the omitted group). However, firms trading in the OTC Pink tier and the Grey Market have higher levels of short interest than firms in the top tier, OTCQX. These results confirm the univariate outcomes presented in Table 5 and also add support to Hypothesis 5 above. My results are also in line with AST's overpricing model. After including the tier designation dummy variables, the coefficient of *SEC* becomes positive. All of the coefficients in Table 6 have identical signs as those in Table 4.

POSITIVE/NEGATIVE RETURN DAYS

While short selling difficulties are suspected to contribute to the negative returns of OTC securities (Eraker and Ready, 2015, and Bruggemann, Kaul, Leuz, and Werner, 2013), no studies securities have directly examined the effects of short selling difficulties on OTC stock returns. Studies of listed securities do, however, analyze the relation between short interest and returns. Boehmer, Huszer, and Jordan (2010), for example, investigate stocks with lower levels of short interest and find that they outperform stocks heavily shorted. Returns to the portfolio of lightly shorted stocks are greater in absolute value than the returns to the portfolio of heavily shorted stocks. Heavily traded stocks with lower levels of short interest experience positive abnormal returns. Their results that short sellers avoid undervalued securities and sell overvalued securities indicate low levels of short interest could be good news for stock returns. Additionally, Figlewski (1981) finds that stocks with more short interest underperform stocks lightly shorted. Boehmer, Jones, and Zhang (2008) also find that heavily shorted stocks underperform lightly shorted stocks. Unlike Boehmer, Huszer, and Jordan's study, where short sellers intentionally avoid undervalued securities, OTC securities, as a whole, are simply difficult to short at all (AST, 2013).

Hypothesis 6: Stocks with lower levels of short interest will outperform stocks with higher levels of short interest.

Due to data limitations regarding reverse stock splits and dividend payouts, I consider only daily returns and examine the percentage of all trading days during the sample period that firm has a positive, negative, or zero return day. Since some OTC securities are extremely

illiquid and do not trade every day, I analyze firm performance using the open-to-close price range expressed as a percentage of the open price. This return calculation is similar to what is used to analyze IPO returns (e.g., Loughran and McDonald, 2013). While positive/negative return days may follow daily market trends, I mitigate some of this concern by comparing differences in return days by tier. In other words, since most OTC firms are subject to systematic risk, differences in return days in one tier relative to another tier could be attributed specifically to the firms and tiers and not market-wide movements.

I present my exploration of Hypothesis 6 in Table 7. I partition my sample in short interest quartiles, where Q4 (Q1) represents firms with the most (least) short interest. I then compare the difference in positive return days, zero return days, and negative return days within the top and bottom short interest quartiles. Panel A presents the percentage of positive, negative, and zero return days according to short interest quartiles. Firms with the highest levels of short interest experience positive returns on 28% of trading days, whereas firms in the lowest short interest quartile only earn positive returns on 14% of trading days. It is worth noting the overwhelming proportion of zero return days for firms within each short interest quartile. Firms in Q4 (Q1) have identical opening and closing prices over 40% of the days in the sample. Perhaps the lack of daily price movement helps explain the insignificant relation between short interest and daily price volatility presented in previous tables.

In Panel B, I compare differences in return days between Q4 and Q1. I find that firms with more short interest (Q4) have more positive return days than firms with less short interest (Q1). While Panel B compares return days between quartiles, Panel C compares positive return days with negative return days for firms within the same short interest quartile. The differences between positive and negative return days are significant in Q2 and Q3, but insignificant in Q1

and Q4. These results considered jointly with those in Panel B indicate that firms with higher levels of short interest have more positive return days than firms with lower levels of short interest. However, firms within each quartile appear equally likely to have a positive or negative return day.

SHORT INTEREST AND CAVEAT EMPTOR FLAG

OTC Markets Group identifies securities within each tier that are subject to a stock spam campaign, fraud or criminal investigation, undisclosed corporate actions (e.g. reverse merger, stock split, name change), or a trading suspension/halt (among other reasons) with a "Caveat Emptor" (i.e. buyer beware) flag. Investors are encouraged to exercise additional caution and perform a thorough examination of securities with this flag before investing. Bruggemann, Kaul, Leuz, and Werner (2013) find that the Caveat Emptor label is directly related to crash risk (i.e. negative return skewness). Consequently, I present the following hypothesis:

Hypothesis 7: Short interest decreases for firms receiving a Caveat Emptor designation.

Panel A of Table 8 presents a difference in (short interest) means test between firms with a Caveat Emptor flag relative to firms that do not have a Caveat Emptor flag. I examine 495 firms in the sample that have a Caveat Emptor flag and find that firms with this identification have similar levels of short interest than firms without this indicator flag. To specifically address Hypothesis 7, I perform an event study by examining 283 firms that receive a Caveat Emptor designation during the sample period. Given the nature of bimonthly reporting of short interest, my empirical setup favors a non-result for firms that may only temporarily receive the buyer beware flag. Panel B shows that short interest decreases for firms receiving the Caveat Emptor designation. Perhaps this result, in support of Hypothesis 7, shouldn't come as a surprise given that a large portion of these Caveat Emptor securities trade in sub-penny increments below $0.01 (Davis, 2015). However, as seen in Figure 1, some penny stocks trading in subpennies still display some level of investor disagreement (i.e. have shares available for shorting).

I also include a *Caveat Emptor* dummy variable in the multivariate analysis. I report the coefficient results of this analysis in Panel B of Table 8. The coefficient of *Caveat Emptor* is not statistically different from zero suggesting that firms receiving the "buyer beware" flag have similar levels of short interest as firms that do not receive this indicator flag. All other coefficients reported in Table 8 are identical to those reported in Table 6. Although Bruggemann, Kaul, Leuz, and Werner (2013) control for the buyer beware flag in their analyses, the Caveat Emptor dummy variable does not appear to be a critical control variable in my study of short interest.

CHANGES IN SHORT INTEREST

The last portion of my analysis studies firms that have the largest change in short interest over the sample period. Examining firms with extreme variation in short interest over the sample period may provide additional support to what is reported in previous tables. I take the range between each firm's maximum short interest value and minimum short interest value over the sample period and divide it by shares outstanding. I next partition the sample into quartiles based on changes in short interest. Q4 (Q1) represents firms with the largest (smallest) change over the sample period. I then examine the makeup of the firms within each quartile.

In Figure 2, I show that over 75% of the firms with the largest range in short interest over the sample period (i.e. Q4 bars) trade in the OTC Pink tier and the Grey Market. Regardless of the quartile, Pink and Grey firms tend to make up the largest portion of each quartile. However, short interest in OTCQX and OTCQB firms remains relatively stable over time. As seen in Figure 3, firms with the largest (smallest) changes in short interest tend to be higher priced (lower priced) OTC securities.

Perhaps firms with the largest changes in short interest have higher daily returns than firms that have relatively stable levels of short interest. The empirical design to address this question is similar to what is presented in Table 7. This time, though, I examine median daily percentage returns according to quartiles (that are based on changes in short interest over the sample period). The results of this analysis are reported in Table 9. I scale changes in short interest by shares outstanding and let Q4 (Q1) represent firms with the largest (smallest) changes in short interest over the sample period. The median return for firms that have the largest

changes in short interest is -0.02%, whereas firms will stable levels of short interest have a median daily return of almost 0.20%. However, the difference between these two quartiles, and all other quartiles, is not significantly different from zero. While I do not find any relation between firms' changes in short interest and daily returns, these results are in line with Diamond and Verrecchia (1987) who state that in the presence short selling difficulties, rational investors may modify their valuations accordingly.

CONCLUSION

Short selling in the OTC market is "difficult, expensive, and rare" (AST, 2013). Previous literature suggests that the difficulty shorting OTC securities, at least in part, explains the observed negative average returns and adds to the lottery-like characteristics of these securities (Eraker and Ready, 2015; Bruggemann, Kaul, Leuz, and Werner, 2013). In this paper I examine short interest in OTC stocks by price, tier, and stock and firm characteristics to determine the effects of transparency on short selling in the OTC market. I also study the daily return performances of securities with differing levels of short interest to determine if OTC securities behaves as predicted by a theoretical model provided by Ang, Shtauber, and Tetlock (2013). I find that larger, more liquid stocks, and stocks in lower information tiers, are easier to short. Lastly, American Depository Receipts (ADRS) are more difficult to short than are common stocks and ordinary shares.

Bruggemann, Kaul, Leuz, and Werner (2013) state that if the OTC market consists of retail investors seeking lottery-like payoffs, then together with restrictions on short selling, sophisticated investors may not be willing to participate in the market. Coupled with liquidity concerns in this marketplace, my results provide support for Eraker and Ready (2015) who suggest that the difficulty shorting OTC stocks adds to the lottery-like feature of these securities.

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APPENDIX

APPENDIX 1: SAMPLE AND DESCRIPTIVE STATISTICS

Table 1: Sample & Descriptive Statistics

Panel A classifies the sample of securities by security type and tier designation. Ordinary Shares are common stock of foreign companies. American Depository Receipts (ADRs) are issued by a U.S. depository bank and provide investors the opportunity to own and trade international securities in U.S. dollars during normal U.S. trading hours. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on OTC Link ATS or on OTCBB and are designated to the Grey Market. Panel B provides summary statistics. *Short Interest* is the number of shares sold short for a security divided by shares outstanding, expressed as a percent. *PNT* is the percentage of days during the sample period that a security does not trade. *Price* is share price. *# Trades* is the number of trades in each security by day. *Range* is daily high price minus daily low price divided by closing price, expressed as a percentage. *Market Cap* is price multiplied by shares outstanding and is reported in millions. Each variable is found at the security level first and then averaged.

Panel A

	OTCQX	OTCQB	OTC Pink	Grey	Other	Total
Common Stock	31	1262	1592	83	1076	4,044
Ordinary Shares	128	106	1116	1213	445	3,008
ADRs	96	5	957	21	45	1,124
Total	255	1,373	3,665	1,317	1,566	8,176

Panel B

	Mean	P25	Median	P75	sigma
Short Interest %	0.0709	0.0003	0.0029	0.0211	0.2485
PNT	49.96	16.47	55.08	81.89	33.65
Price	8.59	0.05	0.67	9.10	18.05
# Trades	11.23	1.80	3.08	8.06	24.39
Range	6.84	0.47	2.48	10.44	9.25
Market Cap	4,269,790	2,682	26,303	1,498,595	13,535,126

APPENDIX 2: DIFFERENCES IN SHORT INTEREST BETWEEN MARKET QUALITY QUARTILES

Table 2: Differences in Short Interest between Market Quality Quartiles

Panel A presents average short interest classified according to differing market quality metric. Panel B (Panel C) tests the differences in means of short interest within the different market quality metric quartiles. *Short Interest* is the number of shares sold short for a security divided by shares outstanding, expressed as a percent, averaged by firm over the sample period. *Volatility* is daily high price minus daily low price divided by closing price, expressed as a percentage; *PNT* is the percentage of days during the sample period that a security does not trade; *# Trades* is the number of trades in each security by day. In Panel C, $1.00 and $5.00 represent different penny stock price thresholds. All variables are trimmed at the 1% and 99% levels.

Panel A				
	Q4	Q3	Q2	Q1
Volatility	0.1477	0.0975	0.3522	0.537
PNT	0.6164	0.1144	0.1254	0.2799
# Trades	0.3108	0.0697	0.105	0.6496
Panel B				
	Q4	Q1	Diff	t-stat
Volatility	0.1477	0.537	-0.3893*	-1.93
PNT	0.6164	0.2799	0.3364	1.35
# Trades	0.3108	0.6496	0.3388	-1.34
Panel C				
	Under	Over	Diff	t-stat
$1.00	0.1059	0.4887	-0.3828***	-2.81
$5.00	0.1761	0.5054	-0.3293*	-1.81

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 3: SHORT INTEREST AND LOTTERY CHARACTERISTICS

Table 3: Short Interest and Lottery Characteristics

This table presents results of aggregated variables for each firm over the entire sample period using a Tobit analysis. *Short Interest*, the dependent variable, is the number of shares sold short for a security divided by shares outstanding, expressed as a percent. *PNT* (percentage of days with no trading) is the dependent variable. *Price* is average price. *# Trades* is the average number of trades per day. *Range* is the average of the daily high price minus low price divided by the closing price expressed as a percentage. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *<$1.00* is a dummy variable indicating whether the security is priced below one dollar. All variables are trimmed at the 1% and 99% levels. Robust t-statistics are reported in parentheses.

$$ShortInterest_i = \beta_0 + \beta_1 PNT_i + \beta_2 \#Price_i + \beta_3 \#Trades_i + \beta_4 \#Range_i + \beta_5 \log(MktCap)_i + \beta_6 SEC_i + \beta_7 Dollar + \varepsilon_i$$

	(1) Short Interest	(2) Short Interest
PNT	-0.0007***	-0.0007***
	(-6.074)	(-6.141)
Price	0.0001	
	(0.863)	
# Trades	0.0006**	0.0005**
	(2.558)	(2.513)
Range	0.0002	0.0008*
	(0.468)	(1.763)
MktCap (log)	0.0114***	0.0065***
	(10.364)	(5.005)
SEC	0.0137**	0.0157**
	(2.076)	(2.381)
< $1.00		-0.0649***
		(-6.646)
Constant	-0.1246***	-0.0062
	(-5.495)	(-0.208)
Observations	8,128	8,128

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 4: DIFFERENCES IN SHORT INTEREST BY SECURITY TYPE

Table 4: Differences in Short Interest by Security Type

Panel A presents differences in means tests of short interest between differing security types. Panel B presents results of aggregated variables for each firm over the entire sample period using a Tobit analysis. *Short Interest*, the dependent variable is the number of shares sold short for a security divided by shares outstanding, expressed as a percent. *PNT* (percentage of days with no trading) is the dependent variable. *Price* is average price. *# Trades* is the average number of trades per day. *Range* is the average of the daily high price minus low price divided by the closing price expressed as a percentage. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *<$1.00* is a dummy variable indicating whether the security is priced below one dollar. *ADR* is an indicator variable equal to one if the security is an ADR, zero otherwise. American Depository Receipts (ADRs) are issued by a U.S. depository bank and provide investors the opportunity to own and trade international securities in U.S. dollars during normal U.S. trading hours. All variables are trimmed at the 1% and 99% levels. Robust t-statistics are reported in parentheses.

$$ShortInterest_i = \beta_0 + \beta_1 PNT_i + \beta_2 \#Price_i + \beta_3 \#Trades_i + \beta_4 \#Range_i + \beta_5 \log(MktCap)_i + \beta_6 SEC_i + \beta_7 Dollar + \beta_8 ADR_i + \varepsilon_i$$

Panel A: Short Interest by ADRs				
ADR?	Yes	No	Diff	t-stat
	0.1337	0.3085	-0.17487	-1.49
Panel B: Tobit Analysis		Short Interest		Short Interest
PNT		-0.0008***		-0.0008***
		(-7.232)		(-7.364)
Price		0.0001		
		(0.819)		
# Trades		0.0009***		0.0009***
		(4.401)		(4.447)
Range		0.0001		0.0009*
		(0.261)		(1.754)
MktCap (log)		0.0182***		0.0126***
		(13.810)		(8.851)
SEC		-0.0004		0.0015
		(-0.060)		(0.223)
< $1.00				-0.0764***
				(-7.777)
ADR		-0.1718***		-0.1783***
		(-15.900)		(-16.543)
Constant		-0.2158***		-0.0787**
		(-8.533)		(-2.527)
Observations		8,128		8,128

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 5: DIFFERENCES IN SHORT INTEREST BY TIER

Table 5: Differences in Short Interest by Tier

This table presents differences in means of short interest by tier designation. *Short Interest* is the number of shares sold short for a security divided by shares outstanding, expressed as a percent, averaged over the sample period. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on OTC Link ATS or on OTCBB and are designated to the Grey Market. All variables are trimmed at the 1% and 99% levels.

OTCQX	OTCQB	OTC Pink	Grey	Diff	t-stat
0.0874	0.1166			-0.0292	-0.45
0.0874		0.2042		-0.1168***	-2.59
0.0874			0.7387	-0.6513*	-1.92
	0.1166	0.2042		-0.0876*	-1.78
	0.1166		0.7387	-0.6221*	-1.83
		0.2042	0.7387	-0.5345	-1.57

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 6: SHORT INTEREST AND TIER DESIGNATION REGRESSIONS

Table 6: Short Interest & Tier Designation Regressions

This table presents results of aggregated variables for each firm over the entire sample period using a Tobit analysis. *Short Interest*, the dependent variable is the number of shares sold short for a security divided by shares outstanding, expressed as a percent. *PNT* (percentage of days with no trading) is the dependent variable. *Price* is average price. *# Trades* is the average number of trades per day. *Range* is the average of the daily high price minus low price divided by the closing price expressed as a percentage. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *<$1.00* is a dummy variable indicating whether the security is priced below one dollar. *ADR* is an indicator variable equal to one if the security is an ADR, zero otherwise. *OTCQB*, *OTC Pink* and *Grey* are dummy variables equal to one if the security is designated to the OTCQB, OTC Pink, or Grey tier/market, respectively, zero otherwise. All variables are trimmed at the 1% and 99% levels. Robust t-statistics are reported in parentheses.

$$ShortInterest_i = \beta_0 + \beta_1 PNT_i + \beta_2 \#Price_i + \beta_3 \#Trades_i + \beta_4 \#Range_i + \beta_5 \log(MktCap)_i + \beta_6 SEC_i + \beta_7 Dollar + \beta_8 ADR_i + \beta_9 OTCQB_i + \beta_{10} Pink_i + \beta_{11} Grey_i + \varepsilon_i$$

	Short Interest	Short Interest
PNT	-0.0010***	-0.0010***
	(-8.341)	(-8.657)
Price	0.0001	
	(0.856)	
# Trades	0.0009***	0.0009***
	(4.281)	(4.350)
Range	-0.0001	0.0006
	(-0.217)	(1.211)
Mkt Cap (log)	0.0173***	0.0110***
	(12.731)	(7.503)
SEC	0.0180**	0.0262***
	(2.279)	(3.302)
< $1.00		-0.0857***
		(-8.483)
ADR	-0.1681***	-0.1780***
	(-13.686)	(-14.500)
OTCQB	-0.0185**	-0.0320***
	(-2.203)	(-3.758)
OTC Pink	0.0174**	0.0204***
	(2.202)	(2.602)
Grey	0.0478***	0.0505***
	(3.924)	(4.159)
Constant	-0.2077***	-0.0517
	(-7.638)	(-1.585)
Observations	8,128	8,128

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 7: POSITIVE AND NEGATIVE RETURN DAYS

Table 7: Positive and Negative Return Days

I partition my sample in short interest quartiles, where Q4 (Q1) represents firms with the most (least) short interest. I then compare the difference in positive return days, zero return days, and negative return days within the top and bottom short interest quartiles. Panel A presents the percentage of positive, negative, and zero return days according to short interest quartiles. Panel B compares return days between the top and bottom quartiles. Panel C compares positive return days with negative return days within the same short interest quartiles. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on OTC Link ATS or on OTCBB and are designated to the Grey Market. Panel C partitions the sample into short interest quartiles and calculates a difference in means test in percentage return days. Q4 (Q1) represents firms with more (less) short interest. Panel D compares differences in positive return days and negative return days based on short interest quartiles. All variables are trimmed at the 1% and 99% levels.

Panel A				
	Short Q4	Short Q3	Short Q2	Short Q1
% Positive Return Days	28.64	30.10	24.88	14.53
% Zero Return Days	41.93	42.10	53.12	70.24
% Negative Return Days	29.43	27.80	22.00	15.22
Panel B				
	Short Q4	Short Q1	Diff	t-stat
% Positive Return Days	28.64	14.53	14.10***	28.26
% Zero Return Days	41.93	70.24	-28.31***	-32.69
% Negative Return Days	29.43	15.22	14.21***	27.81
Panel C				
	% Positive Return Days	% Negative Return Days	Diff	t-stat
Short Interest Q4	28.64	29.43	-0.7953	-1.38
Short Interest Q3	30.10	27.80	2.30***	4.74
Short Interest Q2	24.88	22.00	2.89***	6.41
Short Interest Q1	14.53	15.22	-0.69	-1.64

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 8: CAVEAT EMPTOR

Table 8: Caveat Emptor

OTC Markets Group identifies securities within each tier that are subject to a stock spam campaign, fraud or criminal investigation, undisclosed corporate actions (e.g. reverse merger, stock split, name change), or a trading suspension/halt (among other reasons) with a "Caveat Emptor" (i.e. buyer beware) flag. Investors are encouraged to "exercise additional care and perform thorough due diligence" when investing in securities with this flag. The first portion of Panel A presents differences in means tests of short interest between firms with and without Caveat Emptor flags. The second portion of Panel A reports a difference in short interest means test comparing short interest in firms before versus after receiving the Caveat Emptor flag. Panel B reports the results of a Tobit Analysis. *Short Interest*, the dependent variable is the number of shares sold short for a security divided by shares outstanding, expressed as a percent. *PNT* (percentage of days with no trading) is the dependent variable. *Price* is average price. *# Trades* is the average number of trades per day. *Range* is the average of the daily high price minus low price divided by the closing price expressed as a percentage. *Mkt Cap* is the log of share price multiplied by shares outstanding. *SEC* is an indicator variable equal to one if the firm is registered with the SEC, zero otherwise. *<$1.00* is a dummy variable indicating whether the security is priced below one dollar. *ADR* is an indicator variable equal to one if the security is an ADR, zero otherwise. *OTCQB*, *OTC Pink* and *Grey* are dummy variables equal to one if the security is designated to the OTCQB, OTC Pink, or Grey tier/market, respectively, zero otherwise. *Caveat Emptor* is a binary variable equal to one if the firm receives a Caveat Emptor designation during the sample period, zero otherwise. All variables are trimmed at the 1% and 99% levels. Robust t-statistics are reported in parentheses.

$$ShortInterest_i = \beta_0 + \beta_1 PNT_i + \beta_2 \#Price_i + \beta_3 \#Trades_i + \beta_4 \#Range_i + \beta_5 \log(MktCap)_i + \beta_6 SEC_i + \beta_7 Dollar + \beta_8 ADR_i + \beta_9 OTCQB_i + \beta_{10} Pink_i + \beta_{11} Grey_i + \beta_{11} CaveatEmptor_i + \varepsilon_i$$

Panel A: Short Interest by Caveat Emptor				
Does firm have Buyer Beware Flag?	Yes	No	Diff	t-stat
Short Interest %	0.1010	0.2947	-0.1937**	-2.42
Panel B: Event Study	Before Receiving Flag	After Receiving Flag	Diff	t-stat
Short Interest %	0.0646	0.0290	0.0355*	1.73

Panel C: Tobit Analysis	Short Interest	Short Interest
PNT	-0.0010***	-0.0010***
	(-8.316)	(-8.609)
Price	0.0002	
	(0.891)	
# Trades	0.0009***	0.0009***
	(4.297)	(4.372)
Range	-0.0001	0.0006
	(-0.152)	(1.289)
Mkt Cap (log)	0.0172***	0.0107***
	(12.459)	(7.191)
SEC	0.0183**	0.0267***
	(2.309)	(3.346)
ADR	-0.1678***	-0.1775***
	(-13.605)	(-14.429)
< $1.00		-0.0862***
		(-8.471)
OTCQB	-0.0194**	-0.0335***
	(-2.289)	(-3.868)
OTC Pink	0.0171**	0.0200**
	(2.167)	(2.554)
Grey	0.0477***	0.0502***
	(3.912)	(4.142)
Caveat Emptor	-0.0116	-0.0172
	(-0.865)	(-1.285)
Constant	-0.2049***	-0.0470
	(-7.467)	(-1.415)
Observations	8,128	8,128

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level

APPENDIX 9: MEDIAN RETURNS

Table 9 Median Returns

Panel A presents the median percentage daily returns of firms partitioned according to changes in short interest over the period. I first take the range of each firm's high short interest value and low short interest value over the sample period and divide it by shares outstanding. I then partition the sample into quartiles, where Q4 (Q1) represents firms with the largest (smallest) range. Panel A presents the medians by quartile. Panel B tests the difference in the medians between the differing quartiles. Median % Daily Return is the median daily return percentage, averaged across firms.

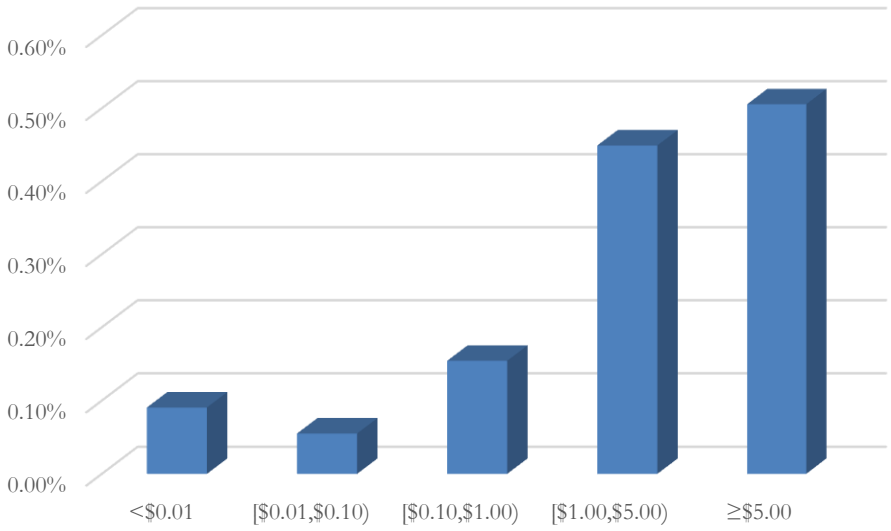
Panel A						
	Q4	Q3	Q2	Q1		
Median % Daily Returns	-0.0036	0.1059	0.0839	0.0017		
Panel B						
	Q4	Q3	Q2	Q1	Diff	t-stat
Median % Daily Returns	-0.0036			0.0017	-0.0053	-0.15
Median % Daily Returns	-0.0036		0.0839		-0.0875	-1.38
Median % Daily Returns	-0.0036	0.1059			-0.1095	-1.62
Median % Daily Returns		0.1059	0.0839		0.02	0.25
Median % Daily Returns		0.1059		0.0017	0.1042	1.49
Median % Daily Returns			0.0839	0.0017	0.0822	1.25

*** Statistically significant at the 0.01 level; ** Statistically significant at the 0.05 level; * Statistically significant at the 0.10 level; *

APPENDIX 10: SHORT INTEREST BY FIRM PRICE

Figure 1 Short Interest by Firm Price

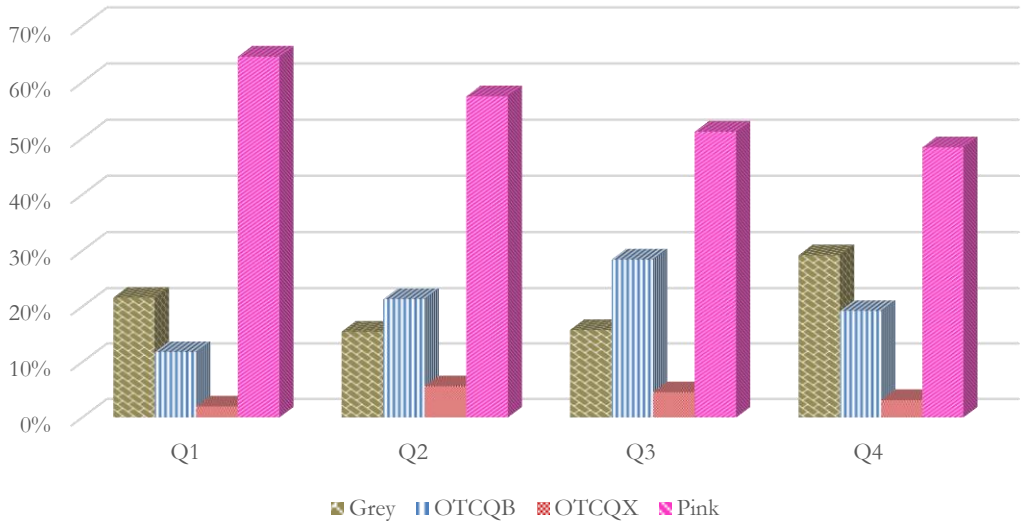
This figure reports short interest percentages by price. *Short Interest*, the dependent variable is the number of shares sold short for a security divided by shares outstanding, expressed as a percent.



APPENDIX 11: FIRMS BY SHORT INTEREST QUARTILE AND TIER

Figure 2 Firms by Short Interest Quartile and Tier

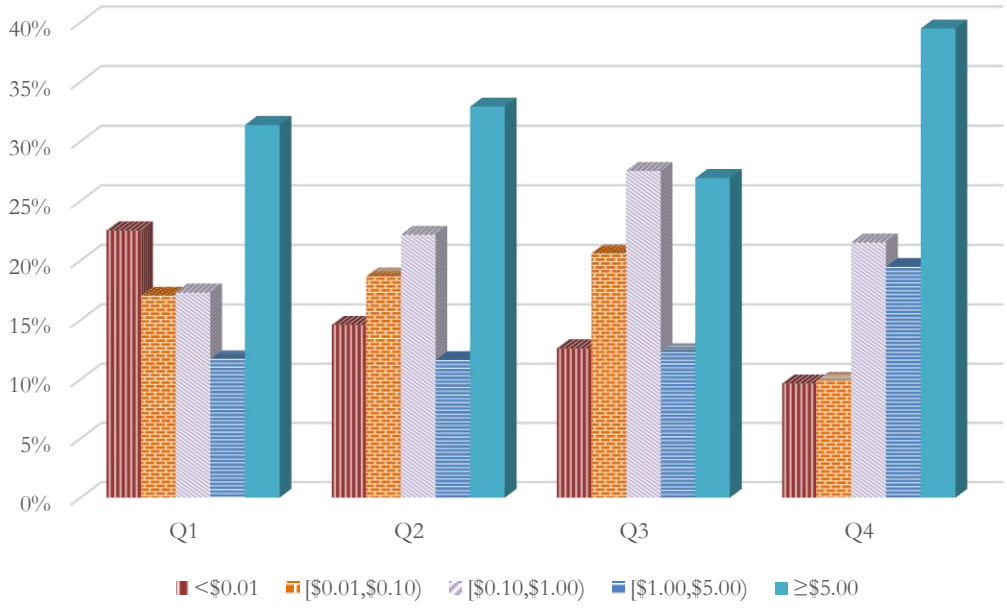
This figure reports the percentage of firms within each (change in) short interest quartile, by tier. I first take the range of each firm's high short interest value and low short interest value over the sample period and divide it by shares outstanding. I then partition the sample into quartiles, where Q4 (Q1) represents firms with the largest (smallest) range. I then categorize each quartile according to tier. Firms on OTCQX meet the highest standards. OTCQB firms are current in their reporting, but do not qualify for OTCQX. OTC Pink firms are either unable or willing to provide adequate levels of information and transparency. Securities not quoted on OTC Link ATS or on OTCBB and are designated to the Grey Market.



APPENDIX 12: FIRMS BY SHORT INTEREST QUARTILE AND PRICE

Figure 3 Firms by Short Interest Quartile and Price

This figure reports the percentage of firms within each (change in) short interest quartile, by price. I first take the range of each firm's high short interest value and low short interest value over the sample period and divide it by shares outstanding. I then partition the sample into quartiles, where Q4 (Q1) represents firms with the largest (smallest) range. I then categorize each quartile according to price.



VITA

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EDUCATION

M.B.A., University of Alabama at Birmingham, May 2012
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PUBLICATIONS

Davis, R., Van Ness, B., and R. Van Ness, 2014. "Clustering of High Frequency and Non-High Frequency Trades," *The Financial Review* 49, 2, 421-433.

DISSERTATION

- Essay 1: "Seeing through the Tiers: Trading in the Modern OTC Marketplace OTC Marketplace."
- Essay 2: "An Analysis of Penny Stocks and Listed Securities Trading Under Five Dollars"
- Essay 3: "Risk, Uncertainty, and Divergence of Opinion: Short Selling in the OTC Market"

WORKING PAPERS

- Davis, R., Roseman, B., Van Ness, B. and R. Van Ness. "Canary in Coal Mine? One Share Orders and Trades."
- Box, T., Davis, R., Hill, M., and C. Lawrey. "Operating Performance and Aggressive Trade Credit Policies."
- Davis, R., Jurich, S., Roseman, B., and E. Watson. "Market Information and Price Clustering: Evidence from SEC Rule 201."
- Davis, R. "XL Ticker Wars."
- Box, T., Davis, R., and K. Fuller. "ETF Competition and Consequences on Market Quality."

WORKS IN PROGRESS

- Davis, R., Lawrey, C., and K. Fuller. "IPO Dividends."

ACADEMIC EXPERIENCE

University of Mississippi, Graduate Instructor, Oxford, MS, 2014-current
University of Mississippi, Graduate Teaching and Research Assistant, Oxford, MS, 2012-2014
Birmingham-Southern College, Mathematics Instructor, Birmingham, AL, 2009-2012
Volunteer State Community College, Adjunct Mathematics Instructor, Gallatin, TN, 2007-2012
Jefferson State Community College, Adjunct Mathematics Instructor, Birmingham, AL, 2011-2012
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REFEREE EXPERIENCE

Referee for *Journal of Banking and Finance* (2014, 2015, 2016)
Referee for *The Financial Review* (2015, 2015)

PRESENTATIONS

- Davis, R., Roseman, B., Van Ness, B. and R. Van Ness. "Canary in Coal Mine? One Share Orders and Trades." Presented at the Eastern Finance Association Annual Meeting, April 2015.
- Davis, R. "XL Ticker Wars." Presented at the Eastern Finance Association Annual Meeting, April 2015.
- Davis, R., Roseman, B., Van Ness, B. and R. Van Ness. "Canary in Coal Mine? One Share Orders and Trades." Presented at the Midwest Finance Association Annual Meeting, March 2015.
- Davis, R., Roseman, B., Van Ness, B. and R. Van Ness. "Canary in Coal Mine? One Share Orders and Trades." Presented at the Southern Finance Annual Meeting, November 2014.
- Davis, R., Roseman, B., Van Ness, B. and R. Van Ness. "Canary in Coal Mine? One Share Orders and Trades." Presented at the Financial Management Annual Meeting, October 2014.

SERVICE

- Session Chair and Discussant, Eastern Finance Association Annual Meeting, New Orleans, Louisiana, 2015.
- Discussant, Financial Management Association Annual Meeting, Nashville, Tennessee, 2014.

HONORS AND AWARDS

2015 AFA Student Travel Grant Recipient
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2012-2015 University of Mississippi Graduate Teaching and Research Assistant
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COURSES TAUGHT

Business Finance I
Personal Finance
Business Calculus
Calculus 1, 2, 3
Differential Equations
Elementary Statistics
Mathematical Modeling
Pre-Calculus
Math for Liberal Arts
Finite Mathematics
College Algebra
Intermediate Algebra
Elementary Algebra
Basic Mathematics