Asset Pricing in the Dark:

The Cross Section of OTC Stocks

October 2012

Andrew Ang, Assaf A. Shtauber, and Paul C. Tetlock*

Columbia University

Abstract

Compared to listed stocks, OTC stocks are far less liquid, disclose less information, and exhibit lower institutional holdings. We exploit these different market conditions to test theories of cross-sectional return premiums. Compared to return premiums in listed markets, the OTC premium for illiquid stocks is several times higher, the OTC premiums for size, value, and volatility are similar, and the OTC premium for momentum is three times lower. The OTC premiums for illiquidity, size, value, and volatility are largest among stocks that are held almost exclusively by retail investors and those that do not disclose basic financial information. Theories of differences in investors' opinions and short sales constraints help to explain these return premiums. Our momentum results are most consistent with Hong and Stein's (1999) theory based on the gradual diffusion of information.

* The authors thank Bill Aronin for making available MarketQA data. We appreciate helpful comments from Andrew Karolyi (editor), David Hirshleifer (executive editor), two anonymous referees, Randy Cohen, Kent Daniel, Larry Harris, Cam Harvey, Narasimhan Jegadeesh, Charles Jones, Rossen Valkanov, and Adrien Verdelhan, as well as seminar participants at the Western Finance Association meetings, the University of Arizona, and Columbia University. Please send correspondence to paul.tetlock@columbia.edu.

While hundreds of studies have investigated expected return patterns in listed stocks that trade on the NYSE, Amex, and NASDAQ, many US stocks—roughly one-fifth of the number of stocks listed on the major exchanges—trade in OTC markets. The definition of an OTC stock is one that trades on either the OTC Bulletin Board (OTCBB) or OTC Link (formerly Pink Sheets, or PS) interdealer quotation system, where at least one licensed broker-dealer agrees to make a market in the stock. We examine market data for 6,668 OTC firms from 1977 through 2008. To our knowledge, this is the largest dataset of US stock prices to be used in research since the Center for Research on Security Prices (CRSP) added data on NASDAQ stocks in 1984.

The OTC and listed stock markets consist of many similar firms and market participants. More than 80% of OTC firms with market capitalizations above $1 million are traded in listed markets either before, concurrently, or after their OTC trading activity. Most broker-dealers who act as market makers in OTC stocks are also market makers in listed markets. Moreover, many investors, including retail investors and hedge funds, actively trade both groups of stocks.

There are, however, three important differences between OTC and listed stocks. First, there is far lower liquidity in OTC markets than on the major exchanges. Second, whereas firms in listed stock markets must file regular financial disclosures, disclosure requirements for firms traded in OTC markets are minimal, if non-existent, for most of our sample period.[2] Third, we provide evidence that non-institutional (i.e., retail) investors are the primary owners of most OTC stocks, whereas institutional investors hold significant stakes in nearly all stocks on listed exchanges, including small stocks. In addition to the large variation across OTC and listed stocks, there is large variation among OTC stocks: a significant minority of OTC stocks exhibit high liquidity, information transparency, and institutional holdings—much like listed stocks.

[2] After June 2000, firms listed on the OTCBB but not the PS must have at least 100 shareholders, file annual reports, hold annual shareholder meetings, and meet other governance requirements (see Bushee and Leuz, 2005).

We exploit these features of OTC and listed stock markets to distinguish among myriad theories of return premiums. Differentiating theories whose predictions depend on stocks' information environments and investor clientele using only the listed markets is hard, if not impossible, because all listed stocks are subject to the same reporting requirements and nearly all are held by institutions.[3] We estimate return premiums both within and across OTC markets and listed markets, sorting stocks by the characteristics that distinguish the two markets. This combined cross-market and within-market identification strategy allows for powerful tests of competing theories because the data exhibit enormous heterogeneity along both dimensions.

In light of the large cross-market differences in liquidity, we devote special attention to measuring illiquidity premiums. We find that the return premium for illiquid stocks is much higher in OTC markets than in listed markets. One of our key liquidity measures is the proportion of non-trading days (*PNT*), and we sort OTC stocks into *PNT* quintiles. When constructing listed return factors, we focus on "comparable" listed stocks with market capitalizations similar to the typical OTC stock to control for differences in firm size. We find that an OTC illiquidity factor returns has an annualized Sharpe ratio of 0.91, whereas the comparable listed illiquidity factor returns has a Sharpe ratio of just 0.14.

We also test whether the well-known return premiums for stocks with low market capitalizations ("size"), high ratios of book equity to market equity ("value" or B/M), low idiosyncratic volatility ("volatility"), and high past returns ("momentum") generalize to OTC markets.[4] Interestingly, the return premiums for size, value, and volatility are similarly large in

---

[3] Researchers can also use international data, like Bekaert, Harvey, Lundblad (2007) who estimate illiquidity premiums, or different asset classes like Karolyi and Sanders (1998), to investigate determinants of return premiums. International studies are hampered by different treatments of creditor rights and different asset classes have the disadvantage that the securities are not the same.

[4] Studies of listed stocks by Banz (1981), Fama and French (1992), Ang et al. (2006), and Jegadeesh and Titman (1993) provide early evidence of the size, value, volatility, and momentum premiums, respectively.

OTC markets and comparable listed markets. In contrast, the return premium for momentum is considerably smaller and less robust in OTC markets than in listed markets.[5]

We find that traditional factor models that include listed return factors based on the market, size, value, momentum, and illiquidity cannot explain the large illiquidity, size, value, and volatility return premiums in OTC markets. We also show that the correlations between OTC return factors and their listed counterparts are typically well below 0.5. The correlation between the OTC illiquidity factor and the listed Pastor and Stambaugh's (2003) illiquidity factor is close to zero. These facts show that the OTC factor structure differs significantly from the listed structure, presenting a challenge for explanations of return premiums based on economy-wide common risk factors.

We next test whether several theories can explain how premiums differ within OTC and listed markets. Models analyzing the impact of differences in opinions, attention, and short sales constraints could be relevant for both OTC and listed markets. Miller (1977) reasons that, when investors' opinions differ, short sales constraints restrict participation to investors with the most optimistic views of a stock. This causes overpricing followed by negative risk-adjusted returns. Miller (1977) further contends that "investor awareness" of a stock is crucial for differences in opinion to raise stock prices because investors who are unaware of stocks cannot buy them, regardless of their opinions. His theory predicts that stocks associated with investor disagreement and attention should have negative risk-adjusted returns.[6] Stocks with high volume, volatility, and valuations (M/B) are associated with investor disagreement in Scheinkman and Xiong's (2003) theory of overconfident investors and short sales constraints. Similarly, high volume,

[5] Momentum is often thought of to be pervasive in that it occurs in many different countries and asset classes (see, for example, Asness, Moskowitz, and Pedersen (2012)).
[6] Merton's (1987) theory also predicts that investor recognition negatively predicts a stock's expected return.

volatility, valuations, and size have been used as empirical proxies for investor attention.[7] Miller's (1977) and related theories could help explain the return premiums associated with illiquidity, size, volatility, and value if these variables are proxies for disagreement and attention.

To test this conjecture, we first examine whether these four premiums are higher among stocks held almost exclusively by retail investors. Barber and Odean (2000) suggest that active retail traders are overconfident and thus might sharply disagree based on their private signals. Furthermore, many studies suggest that retail investors are the main cause of attention-driven upward pressure on stock prices. Empirically, we use a stock's institutional ownership as an inverse measure of retail investor ownership. We find that the return premiums for *PNT*, volume, volatility, value, and size are 1.0% to 4.4% per month larger in OTC stocks that are not held by institutions. This evidence is consistent with theories in which high retail investor demand for stocks with high volume, volatility, valuations, and size causes temporary overpricing.

Next we examine differences in return premiums according to whether OTC stocks disclose the book value of their equity—basic information with relevance for valuation. Investor disagreement is likely to be greater in stocks that do not disclose such basic information because investors must form their opinions in an informational vacuum. Our evidence indicates that OTC return premiums based on three proxies for disagreement—*PNT*, volume, and volatility—are 1.4% to 1.6% per month larger among stocks that do not disclose book equity.

Our cross-market evidence is consistent with the notion that Miller's (1977) theory of overpricing applies more to OTC markets than listed markets. We show that short sales constraints are tighter in OTC markets; and the lower disclosure and higher proportion of retail clientele in OTC markets suggest investor disagreement could be greater. Consistent with this

[7] Lee and Swaminathan (2000), Huberman and Regev (2001), Barber and Odean (2008), and Fang and Peress (2009) present evidence that these attention proxies are associated with increases in demand and price pressure.

notion, the OTC illiquidity premium exceeds the listed premium. Moreover, we find that the return on the entire OTC market is actually negative at –9.0% per year, implying widespread overpricing of OTC stocks. This negative return is driven by the OTC stocks with the most trading activity, which likely exhibit the highest investor disagreement.

Although Miller's (1977) theory provides a plausible account of many return premiums, it does not make clear predictions for the momentum premium. We investigate momentum further and find evidence that is most consistent with Hong and Stein's (1999) model based on the gradual diffusion of information across investors. The lack of momentum for most OTC stocks is consistent with the idea that investors do not attend closely to most OTC firms' fundamentals, perhaps because these firms lack credibility. We also uncover evidence that momentum is strong among OTC stocks that disclose basic financial information and the largest OTC firms, which presumably have more credibility. Furthermore, momentum among large OTC (listed) firms continues for five years (one year), which is consistent with Hong and Stein (1999) if information diffusion is slower in OTC markets than in listed markets.

We consider several alternative theories that could help explain the two main differences between OTC and listed markets: the liquidity and momentum premiums. For example, illiquid stocks exhibit high expected returns in rational models, such as Amihud and Mendelson (1986), in which illiquid stocks are priced at a discount to compensate investors for their expected trading costs. We find limited support for the predictions from this and other plausible theories. Only a few of these theories match the evidence on the relative magnitudes of return premiums across OTC and listed markets. Those that match the cross-market evidence fail to match the evidence on how return premiums vary within OTC markets.

I. Related Studies of OTC Stocks

Few studies investigate stock pricing in OTC markets. One exception is the contemporaneous study by Eraker and Ready (2010), who investigate the aggregate returns of OTC stocks and find that the average OTC market return is negative. Although we use the OTC market return as a factor in some of our tests, we focus on the cross section of OTC returns. In many cases, the differences among OTC stocks' returns are much larger than the (negative) OTC market premium and actually are not explained by exposures to the OTC market factor.

Studies of OTC firms' liquidity and disclosure are also relevant. Two recent papers examine how liquidity changes for stocks moving from listed stock markets to the OTC markets. Harris, Panchapagesan, and Werner (2008) show that volume falls by two-thirds, quoted bid-ask spreads double, and effective spreads triple for firms that are delisted from NASDAQ in 1999 to 2002 and subsequently trade on OTC markets. Macey, O'Hara, and Pompilio (2008) also find higher spreads for most of the 58 NYSE stocks moving to OTC markets in 2002. These studies suggest that the shift in trading to OTC venues actually causes stocks to become less liquid.

A recent study by Leuz, Triantis, and Wang (2008) investigates a firm's decision to "go dark," which means a firm ceases to report to the SEC while continuing to trade publicly in OTC markets. They find that the 480 firms going dark between 1998 and 2004 experience negative average abnormal returns of –10% upon announcement. Many firms going dark issue press releases stating that their motivation is to reduce compliance costs from disclosure requirements and the Sarbanes-Oxley Act. Relative to firms continuing to report to the SEC, firms going dark are smaller and are experiencing more financial difficulties. Our study analyzes the returns of all OTC firms, including those that have chosen to go dark (a minority), those that have never reported to the SEC, and those that currently report to the SEC (the majority). All OTC firms' past disclosure policies and financial reports are available to investors and thus should be reflected in stock prices insofar as they affect investors' valuations.

II. OTC Market Data

A. Institutional Details

Our data consist of US common stocks traded in the OTCBB and PS markets from 1977 through 2008. We obtain this data through MarketQA, which is a Thomson Reuters data analytics platform. The OTC markets are regulated by the Financial Industry Regulatory Authority (FINRA), formerly the National Association of Securities Dealers (NASD), and the SEC to enhance market transparency, fairness, and integrity. For most of our sample, the defining requirement of an OTC stock is that at least one FINRA (formerly NASD) member must be willing to act as a market maker for the stock.

As of June 11, 2010, over 211 FINRA firms were market makers in OTC stocks, facilitating daily trading activity of $395 million ($100 billion annualized). The most active firms, such as Archipelago Trading Services and Knight Equity Markets, are also market makers in stocks listed on the NASDAQ and are SEC-registered broker-dealers. FINRA requires market makers to trade at their publicly displayed quotations.

Prior to 2000, the key formal disclosure requirement for firms traded on the OTCBB and PS was Section 12(g) of the Exchange Act. This provision applies only to OTC firms with more than 500 shareholders of record and $10 million in assets. Yet the vast majority of beneficial owners of OTC firms are not shareholders of record as their shares are held in "street name" through their brokers. So even large OTC firms can circumvent this disclosure requirement.

FINRA and SEC regulation of OTC markets, however, has increased substantially since 2000. After June 2000, firms quoted on the OTCBB must have at least 100 shareholders, file annual reports, hold annual shareholder meetings, and meet other governance requirements (Bushee and Leuz, 2005). However, these disclosure requirements do not apply to PS firms and did not apply to OTCBB firms for most of our sample.

We later provide evidence suggesting that the majority of investors in the firms traded exclusively on OTC markets are individuals rather than institutions. Individual investors can buy and sell OTCBB and PS stocks through most full service and discount brokers, including Ameritrade, E-Trade, Fidelity, Schwab, and Scottrade. However, short selling OTC stocks is difficult for investors, especially individuals. We collect short selling data for a sample of 50 OTC stocks and 50 similarly-sized listed stocks in June 2012.[8] A retail customer of Fidelity could buy all 100 of these stocks, but the broker would allow short selling in only one of the OTC stocks and eight of the listed stocks. Despite the constraints on individuals, for the 50 listed stocks, short interest as a percentage of floating shares averages 4.1% and exceeds 0.1% for all 50. In contrast, for the 50 OTC stocks, short interest averages just 0.5% and is lower than 0.1% for 28 of the stocks—though it is positive for all but seven stocks. We infer that it is hard for individual investors to short most small stocks; and nearly all investors have difficulty shorting OTC stocks. Thus, the OTC market is a natural place to test theories of short sales constraints.

B. OTCBB and PS Data

We examine the universe of firms incorporated in the US with common stocks that are traded in OTC markets from 1977 through 2008. Our analysis uses only OTC firms without stocks that have been listed on the NYSE, NASDAQ, or Amex exchanges within the last three

[8] These data are available upon request.

months. We purposely exclude listed firms to ensure that we are analyzing a set of firms that is as orthogonal as possible to those listed on the traditional venues. MarketQA provides daily trading volume, market capitalization, and closing, bid, and ask prices for these firms.

To ensure adequate data quality, we further restrict the sample to firms meeting the following requirements in the previous month:

- Non-missing data on stock price, market capitalization, and returns
- Stock price exceeds $1
- Market capitalization exceeds $1 million in 2008 dollars
- At least one non-zero daily return
- Positive trading volume—imposed only after 1995 when volume data are reliable[9]

The price restriction above follows Ince and Porter (2006), who find that errors in computed returns are more likely for firms with prices of less than $1.[10] The market capitalization restriction is designed to eliminate thinly traded and economically unimportant firms that would otherwise dominate equal-weighted portfolios. The non-zero return and positive volume restrictions exclude thinly traded firms that suffer from bid-ask bounce and nonsynchronous trading issues.[11] Our final OTC sample includes an average of 486 firms per month.

C. Comparison to Listed Stocks in CRSP

Here we compare our sample of OTC stocks to common stocks listed on the NYSE, NASDAQ, or Amex exchanges with CRSP data. We define three groups of stocks: active,

[9] Prior to 1995, some OTC firms' volume data is recorded as missing when it is actually zero and vice versa. We set all missing volume to zero prior to 1995 because we find that such firms have low volume when volume data become available. Our results are virtually unchanged if we treat these firms' volume data as missing instead.
[10] In untabulated results, we find that using a minimum price of $0.10 results in similar OTC return premiums.
[11] These filters minimize the impact of market manipulation on our results. Studies by Aggarwal and Wu (2006), Böhme and Holz (2006), and Frieder and Zittrain (2007) show that market manipulation can affect OTC stocks.

eligible, and comparable. *Active* stocks have at least one non-zero daily return in the past year. *Eligible* stocks meet our data requirements in Section II.B. *Comparable* stocks in the listed sample consist of the 2*N* eligible listed firms with the lowest market capitalizations, where *N* is the number of listed firms with a market capitalization below the median market capitalization in OTC markets in each month. These listed firms are comparable to OTC firms in terms of size.

Table 1 provides a snapshot of summary statistics for the OTC, comparable listed, and eligible listed samples in July of 1997—a typical month of OTC market activity. In this month, the median market capitalization of an OTC stock is $12.9 million, as compared to $36 million for the eligible listed sample. The difference in total market capitalization is much larger ($21.3 billion versus $9.59 trillion) because the largest listed firms are enormous and because there are 12 times fewer OTC stocks (600 OTC stocks versus 7,127 listed stocks). The annualized median OTC trading volume is only 2.2% of the median eligible listed trading volume ($2.3 million versus $101 million, respectively).[12] The aggregate annualized transactions in OTC stocks exceed $8.2 billion, whereas trades in eligible listed stocks exceed $11.4 trillion.

[Insert Table 1 here.]

By design, the OTC sample is more similar to the comparable listed sample described in the second column of Table 1. In particular, the median size is identical in the two samples ($12.9 million). Although median sizes match perfectly, the mean size in the OTC markets is larger ($35.5 million) than that of the comparable listed sample (12.7 million) because some OTC firms are quite large, as discussed below.[13] In July 1997, the mean of OTC trading volume at $13.7 million is very similar to that of the comparable listed sample at $12.8 million. Although mean volumes match well, the median OTC volume is smaller than that of the comparable listed

[12] Listed trading volume statistics do not adjust for possible double-counting of NASDAQ interdealer trades.
[13] The average fraction of shares floating is reasonably similar for the smaller samples of 50 OTC firms (53% floating) and 50 similarly-sized listed firms (35% floating) in June of 2012.

sample ($2.3 million vs. $6.1 million, respectively). In summary, the comparable listed sample is a benchmark group that is close in terms of size and trading characteristics to the OTC firms.

Averaging across all months in our sample, the number of firms is 5,228 in the listed sample and is 5,708 in the active listed universe. The averages are 486 in our OTC sample and 3,357 in the active OTC universe. The OTC sample contains fewer firms than the active OTC universe partly because 30% of OTC firms have a stock concurrently listed on the NASDAQ, making them ineligible for the sample.[14] When imposed individually, our sample filters for a non-zero daily return, minimum price of $1, non-missing price, minimum market capitalization of $1 million, and non-missing market capitalization eliminate 28%, 28%, 21%, 19%, and 16% of active OTC firms, respectively. Notably, none of these sample requirements has much impact on the listed sample, which contains 92% of the active firms in CRSP in an average month.

We now compare the size, volume, and number of firms in the OTC and eligible listed samples over time. For this comparison, we transform the size and volume data to minimize the influence of outliers which sometimes reflect data errors. In each month, we compute the difference in the cross-sectional average of the logarithms of size and ($1 plus) volume in the two samples. After taking the difference, we invert the log transform to obtain a ratio that can be interpreted as the OTC characteristic divided by the listed characteristic.

Figure 1 summarizes the relative size, trading volume, and number of firms in the OTC sample as a percentage of the corresponding amounts in the eligible listed sample. The number of firms in the OTC sample averages 10% of the number in the listed sample, though this percentage increased to 24% by the end of 2008. The typical firm size and trading volume in the OTC sample are an order of magnitude smaller than they are in the listed sample. The typical

[14] In untabulated tests, we find that cross-listed OTC and NASDAQ stocks exhibit return premiums much like other listed stocks. The impact of NYSE versus NASDAQ listing choice has been studied in Baruch and Saar (2009) and others. International cross-listing effects have been studied by Baruch, Karolyi, and Lemmon (2007) and others.

OTC stock is on average 11% of the size of the typical listed stock. The typical OTC stock's volume is just 6% of that of the typical stock in the listed sample. The relative size of OTC stocks has almost always been higher than their relative volume, indicating lower liquidity in OTC markets. This gap between relative size and volume widens after 2000, as more illiquid firms are now traded in OTC markets relative to listed markets.[15] The increase in the number of OTC firms in the late 1990s mimics the rise in the number of listed firms, while the increase after 2003 coincides with the Sarbanes-Oxley Act when many listed firms to chose to "go dark."

[Insert Figure 1 here.]

Although the typical OTC firm is smaller than most listed firms, there are several large OTC firms that have market capitalizations similar to large listed firms. Table 2 lists the firm size and month in which the 10 largest firms in our sample attain their peak size. These firms have market capitalizations measured in billions. The largest firm, Publix Supermarkets, reaches a market capitalization of $88 billion at the end of our sample in December 2008. It would rank 18th in size in the listed sample in that month, which exceeds the median of the top percentile. Several large companies, such as Delphi Corp., trade on PS after delisting from NYSE, NASDAQ, or Amex. We inspect the entire time series of data for all 77 OTC firms with peak sizes exceeding $1 billion. We correct 19 errors arising from an incorrect number of shares outstanding. Such errors apply mainly to the largest of these 77 firms and do not affect their returns. Still, these data errors suggest one should be careful when interpreting OTC size data and value-weighted portfolio returns.

[Insert Table 2 here.]

[15] As explained in footnote 9, a structural break in OTC volume reporting causes the gap to appear to widen in July 1995. Average OTC volume would be lower prior to July 1995 if volume data on all OTC firms were available.

In summary, the typical OTC stock is smaller, less liquid, and harder to short than the typical listed stock. However, the largest 10% of OTC stocks are comparable in size to the median-sized listed stock. The number of firms in our OTC sample is substantial, averaging almost 10% of all listed stocks and increasing dramatically after 2000.

III. Variable Definitions

This section summarizes the key variables used in our analyses. Our return predictability tests require estimates of stocks' monthly returns and betas. We also measure several firm characteristics known to predict returns in listed stocks, such as size, book-to-market equity, past returns, idiosyncratic volatility, and illiquidity.

We compute a stock's return as the monthly percentage change in MarketQA's "total return index" variable, which is a cumulative stock price that accounts for dividends and splits.[16] We assign a monthly index value based on the last available daily index value. Our sample filters ensure that this value is available within the last month. Our tests use two past return variables: past one-month returns (*Ret*[-1]) which capture short-term serial correlation and past 12-month returns (*Ret*[-12,-2]), not including the past month, which capture stock price momentum.

Idiosyncratic volatility is defined relative to the Fama-French (1993) three-factor model, as in Ang et al. (2006). To estimate a stock's volatility in month t, we use a time-series regression from month $t – 2$ to $t – 1$ of the stock's daily return on the daily market (MKT), size (SMB) and value (HML) factors, as defined in Fama and French (1993). The stock's idiosyncratic volatility (*Volatility*) in month t is the log of the standard deviation of the residuals

[16] Much like Ince and Porter (2006), we correct firms' returns in cases in which extremely improbable return reversals occur—*e.g.*, a firm's stock price changes from $57.00 to $5.70 and back to $57.00. None of our main results depend on our correction procedure, which is available upon request.

from its time series regression. We use the same regression procedure as described in the Appendix, except that we apply this to daily rather than monthly observations.

Our analyses use three measures of individual stock liquidity. The main illiquidity measure is the proportion of days with no trading volume (*PNT*) in each month. The *PNT* variable measures an investor's ability to trade a stock at all, which is highly relevant in illiquid markets such as the OTC market.[17] The other illiquidity measures capture the amount of a stock that is traded and the price impact of trading a stock. The variable *Volume* is the log of one plus a stock's monthly dollar volume. The variable *Spread* is the difference between a stock's ask and bid quotes divided by the bid-ask midpoint from the last day when both quotes are available.

Our return predictability tests use data on firm disclosure, institutional holdings, size, and book-to-market ratios. Firm disclosure (*Disclose*) is a dummy variable that is one if a firm's book equity data is available from either Compustat, Reuters Fundamentals, or Audit Analytics. We define book equity data as available if it appears in a firm's annual report dated between 7 and 19 months ago. Institutional holdings (*InstHold*) is a dummy variable indicating whether a firm's stock appears as a holding of at least one institutional manager or mutual fund that filed Form 13F, N-CSR, or N-Q with the SEC in the past three months, as recorded by Thomson Reuters. Firm *Size* is the log of the most recently available market capitalization, as computed by MarketQA. The book-to-market variable (*B/M*) is the log of the ratio of book-to-market equity. We winsorize all independent variables at the 5% level to minimize the influence of outliers.

[Insert Table 3 here.]

Table 3 reports summary statistics of returns and variables for OTC stocks and comparable listed stocks in Panels A and B, respectively. The mean monthly return of OTC

[17] Our PNT measure is a more direct way of measuring a lack of trading than Lesmond, Ogden, and Trzcinka's (1999) proportion of days with zero returns, though their measure can be computed without volume data.

stocks is slightly negative at –0.04% compared to 0.66% for comparable listed stocks. The cross section of monthly OTC returns is also significantly more disperse than listed stocks, with cross-sectional standard deviations of 28.08% and 19.46%, respectively. OTC stocks are substantially more volatile than comparable listed stocks, with average monthly average volatilities of 6.56% and 4.29% for the OTC and listed samples, respectively. The size and book-to-market distributions of firms in the OTC and comparable listed samples are similar.

However, the OTC and listed samples exhibit very different levels of disclosure, institutional ownership, and liquidity. The mean of the *Disclose* dummy for book equity data is 0.60 in the OTC sample and 0.83 in the comparable listed sample, suggesting that 40% of OTC firms choose not to disclose accounting data whereas only 17% of small listed firms omit this information.[18] Table 3 shows that an average of 26% of OTC stocks are held by institutions (*InstHold*), as compared to 71% of comparable listed stocks. This suggests that the investor clientele in OTC markets is mainly retail, while institutions play a bigger role in listed markets.

The average of log volume (*Volume*) is much smaller for OTC stocks (8.25) than for listed stocks (10.77). OTC stocks also trade much less frequently: the mean fraction of days with no trading in a month, *PNT*, is 0.55 for OTC stocks compared to 0.20 for listed stocks. The 95th percentile *PNT* value is 0.94, implying the least frequently traded OTC stocks trade just one day per month. Average OTC *Spreads* are quite high at 0.15 versus 0.08 for comparable listed stocks. We explicitly account for the impact of the bid-ask bounce bias in OTC stocks' average returns using the Asparouhova, Bessembinder, and Kalcheva (2010) method described below.

Panel C in Table 3 shows average cross-sectional correlations among OTC firms' characteristics and their betas on listed return factors. Nearly all of the pairwise correlations are

---

[18] Some of the lack of book equity data reflects incomplete coverage in our data sources. In unreported analyses, we find that our three data sources have significantly overlapping coverage, but no single source subsumes the others.

much less than 0.5. The exception is the large negative correlation of –0.84 between *PNT* and *Volume*, which indicates that these two variables reflect a common source of OTC illiquidity.

IV. Comparing the Cross Sections of OTC and Listed Returns

In this section, much like researchers studying listed stocks, we construct calendar-time portfolios of OTC stocks ranked by various characteristics to estimate the expected returns of OTC factors. We compare OTC factor returns to those in the comparable listed sample and those in the eligible listed sample. Forming factors has the advantage that the means of the portfolios have direct economic interpretations as return premiums. The portfolio tests also do not require assumptions of linearity, which regressions impose. The disadvantage of portfolios is that confounding effects can obfuscate return premiums based on univariate sorts. Accordingly, we also present cross-sectional regressions below in which we jointly estimate return premiums. Our analysis focuses on portfolios ranked by two illiquidity measures, *PNT* and *Volume*. We also estimate the returns of factor portfolios ranked by size, value, volatility, and momentum.

To construct portfolios, we sort firms into quintiles at the end of each month based on the firm characteristic of interest, such as a firm's *PNT* value in that month. The portfolio return in month t is the difference between the weighted average returns in month t of firms in the top and bottom quintiles, as ranked by their characteristics in month $t - 1$ among sample firms. Our portfolios use three sets of weights: equal-weighted (EW), value-weighted (VW), and weighted by the prior month's gross return (GRW). As shown in Asparouhova, Bessembinder, and Kalcheva (2010), the expected return of a GRW portfolio is the same as that of an equal-weighted portfolio, except that it corrects for bias induced by bid-ask bounce as identified by Blume and Stambaugh (1983). Each portfolio's excess return is its monthly return minus the monthly risk-free rate prevailing at the end of the prior month. Each portfolio's alpha is the intercept from a time-series regression of monthly excess portfolio returns on various monthly factor returns. All standard errors are based on the robust estimator in Newey and West (1987).[19]

To measure factor loadings in portfolios that may be infrequently traded, we include six monthly lags of each factor and report the sum of the contemporaneous and six lagged coefficients as the factor loading.[20] We analyze five factors based on listed returns, including the MKT, SMB, HML, momentum (UMD), and illiquidity (ILQ) factors. We define UMD using Carhart's 12-month momentum measure (1997) and ILQ using Pastor and Stambaugh's (2003) volume-induced reversal measure. We create a sixth factor equal to the value-weighted OTC market return minus the standard (30-day Treasury Bill) risk-free rate, which we refer to as "OTC Mkt_{VW}." Our three return benchmarks are the OTC CAPM, Listed CAPM, and the Listed Five-Factor models. The OTC CAPM and Listed CAPM models include only the OTC market and listed market factors, respectively. The Listed Five-Factor model consists of the MKT, SMB, HML, UMD, and ILQ factors.

We summarize the return premiums for each OTC return factor in Table 4. Panel A shows the Sharpe ratios of each OTC and listed factor and their information ratios (alphas divided by idiosyncratic volatilities) relative to the factor model benchmarks. Panel B displays the average monthly returns and alphas of each OTC return factor relative to the factor model benchmarks. Panel C shows the listed factor loadings of OTC factors. Panels D and E report the analyses of Panels B and C for comparable listed stocks.

[Insert Table 4 here.]

---

[19] We follow Newey and West's (1994) recommendation to set the number of lags equal to the highest integer less than $4*(T/100)^{(2/9)}$, where T is the number of periods in the sample. For our sample of 383 months, applying this formula results in a lag length of 5 months.

[20] Our method is the monthly analog to the one proposed by Dimson (1979), who analyzes stocks that are infrequently traded at the daily frequency.

Table 4 shows three interesting comparisons between factor premiums in OTC markets and those in comparable listed markets: (1) the illiquidity return premium is much larger in OTC markets; (2) the size, value, and volatility premiums are similar in OTC and listed markets; and (3) the momentum premium is much smaller in OTC markets.

A. Liquidity Premiums

The first four rows of Table 4, Panel A report the illiquidity premiums. The raw Sharpe Ratios of the OTC illiquidity factors based on *PNT* and *Volume* are both very large at 0.91 and –0.90, respectively.[21] Both *PNT*, which captures whether investors trade, and *Volume*, which quantifies how much they trade, appear to be relevant aspects of liquidity for OTC stocks. The average returns of the value-weighted *PNT* factor (PNT_{VW}) are also highly positive and significant. They are lower than the GRW returns partly because size-based weightings place the lowest weights on the least liquid stocks, which have the highest returns.[22]

Panel A also shows that the Sharpe ratios of the illiquidity factors are similar to the information ratios computed using multifactor models. Neither of the models based on listed factors (the Listed CAPM and Listed Five-Factor model) can explain the *PNT* and *Volume* illiquidity premiums. In particular, the Listed Five-Factor model which includes the Pastor-Stambaugh (2003) ILQ factor cannot explain these premiums. In fact, the OTC PNT factor's Sharpe ratio at 0.91 is even larger than its information ratio with respect to the Listed Five-Factor model of 1.34. The OTC illiquidity premiums become larger after controlling for listed risk factors mainly because the OTC illiquidity factors are negatively correlated with the listed

[21] In untabulated results, we find similar illiquidity premiums based on *Spread* and Amihud's (2002) illiquidity ratio.
[22] In general, we do not focus on the value-weighted returns of OTC portfolios because these results are sensitive to interactions between the large OTC size premium and the other factor premiums. Panel A of Table 5 in the following section reports how each return premium varies with firm size.

market return, as shown in Panel C. Furthermore, the listed illiquidity (ILQ) factor of Pastor and Stambaugh (2003) has an insignificant correlation with the OTC illiquidity factors. These results show that exposures to listed factors cannot explain the high OTC return premium for illiquidity.

In contrast to the large OTC illiquidity premium, the listed illiquidity premiums are tiny and insignificant. For comparable and eligible listed stocks, the Sharpe ratios and information ratios based on either liquidity measure are 0.30 or lower and are statistically insignificant.

We graph the cumulative returns for the illiquidity factors in the OTC and comparable listed samples in Figure 2. The figure uses a logarithmic scale to represent the evolution of the value of a $1 investment from December 1976 to December 2008 for the illiquidity factors based on *PNT* in both markets. As additional benchmarks, we include two illiquidity factors from the eligible listed sample: the factor based on *PNT* quintiles and the ILQ factor. In constructing the figure, we assume that an investor begins with $1 long and $1 short and faces no margin or other funding requirements. To facilitate comparison, we scale the long-short portfolio positions in the OTC and eligible listed factors to equate the volatility of these portfolios to the volatility of the long-short portfolio based on the comparable listed factor.

[Insert Figure 2 here.]

Figure 2 shows that the OTC illiquidity factor based on *PNT* quintiles has extremely high cumulative returns. The *PNT* factor performs relatively poorly in the first few years of data when the OTC volume data are less reliable. Its only other notable decline occurs just prior to the March 2000 peak of the NASDAQ index at which time the short side of this portfolio consists of highly liquid, large, and rapidly growing technology stocks. The rise and crash of these liquid technology stocks' prices mirrors the decline and sharp rebound of the illiquidity factor. This episode helps to explain why the OTC *PNT* factor has negative market and SMB betas of –1.24

and –1.02, respectively, and a positive HML beta of 0.89, as shown in Panel C of Table 4. The very negative betas on the market and size factors pose a serious challenge for theories in which the OTC illiquidity premium represents compensation for bearing systematic factor risk.

The magnitude of the OTC *PNT* factor dwarfs the magnitude of all the illiquidity factors constructed using listed stocks. Although the Pastor-Stambaugh factor is the most profitable listed factor, a one-dollar investment in this factor produces $12.05 by the end of the sample. In contrast, a dollar invested the OTC *PNT* factor yields $131 at the end of the sample. Moreover, as Panel A in Table 4 shows, an OTC factor based on another liquidity measure, namely *Volume*, provides very similar Sharpe ratios to those of the OTC *PNT* factor.

Our analysis of illiquidity premiums complements the results from numerous studies of listed US and international stocks, including Amihud and Mendelson (1986), Lee and Swaminathan (2000), Pastor and Stambaugh (2003), Bekaert, Harvey, and Lundblad (2007), and Hasbrouck (2009). These studies show that the least liquid listed stocks have higher returns than the most liquid listed stocks, though the magnitude of the listed illiquidity premium depends on the liquidity measure and time horizon. Using the same liquidity measures and time horizons in both markets, we show that OTC illiquidity premiums dwarf listed illiquidity premiums. Furthermore, Figure 2 demonstrates that the OTC illiquidity premium is larger than the large and well-known listed illiquidity premium studied in Pastor and Stambaugh (2003).

B. Size and Value Premiums

The second notable finding in Table 4 is that the size, value, and volatility premiums well documented in listed markets also exist in OTC markets and have approximately the same magnitudes. Panel A shows that the annualized Sharpe ratios of the GRW size and value factors in the OTC market are –1.02 and 0.82, respectively. These compare to –0.98 and 1.19, respectively, in the comparable listed sample.[23] Thus, we infer that the size and value premiums found in listed markets are robust to the differences across OTC and listed markets.

Despite the similarity in the size and value premiums, neither the listed size nor the listed value factor explains much of the variation in the OTC size and value factors. In Panel B, the alpha of the OTC size factor is –2.81% per month after controlling for its loading on the listed size factor and the other four listed factors. These listed factors explain just 8.1% of the variance in the OTC size factor, as reported in the R^2 columns in Panel C. Even after controlling for the five listed factors, the alpha of the OTC value factor is still 2.29% per month. Although the loading on listed value (HML) factor is positive, all five listed factors explain just 25.3% of the variance in the OTC value factor. This indicates that there are independent size and value factors in the OTC market that are not captured by listed factors.

C. Volatility Premium

Panel A in Table 4 shows that OTC stocks with high volatility have lower average returns than those with low volatility. The Sharpe ratio of the OTC volatility factor at –0.55 is close to the corresponding listed Sharpe ratios at –0.75 and –0.64. Panel B shows that the alpha of the OTC volatility factor with respect to the listed CAPM is significantly negative at –2.63% per month. Thus at first glance, OTC stocks with high idiosyncratic volatility seem to exhibit low returns just like listed stocks with high idiosyncratic volatility.

Interestingly, the OTC volatility factor's negative alpha is much smaller in the OTC CAPM regression. The OTC market itself has an overall negative return: Panel A of Table 4 reports that the Sharpe ratio of the OTC market is –0.52. The fact that there is no idiosyncratic

[23] All OTC and listed value portfolios exclude firms with negative book equity.

volatility effect in OTC markets after controlling for the OTC market factor implies that a single root cause could explain both the low return of the OTC market and the low returns of highly volatile OTC stocks. Panel C shows that the OTC market beta of the long-short OTC volatility factor is 1.07 and that exposure to the OTC market explains 15.5% of the variance in the volatility factor. Panel C of Table 4 also indicates that the OTC volatility factor has a negative loading of –1.38 on the listed illiquidity factor, implying that the volatility effect in OTC stocks is related to the modest illiquidity premium in listed stocks.

D. Momentum

The third key result is that the return premium for momentum in OTC markets is surprisingly small. Whereas the Sharpe ratio of 1.56 for listed momentum is the largest among all the comparable listed premiums in Table 4, Panel A, the Sharpe ratio of 0.41 for OTC momentum is the smallest of the OTC premiums. Panel C in Table 5 shows that the OTC and listed momentum factors are significantly positively correlated.[24] This explains why the information ratio of the OTC momentum factor against the Listed Five-Factor model, which includes listed momentum, is close to zero at 0.09.

The OTC momentum premium shown in Table 4 is much smaller than the momentum premium in listed stocks reported in Jegadeesh and Titman (1993) and the high Sharpe ratio of 1.30 for momentum in the eligible listed universe. The average OTC momentum premium has the same sign as the listed premium, but the magnitude of the OTC premium is at least three times smaller, depending on the exact specification. This evidence contrasts with the robust

[24] Like the listed momentum factor, the OTC momentum factor exhibits statistically and economically significantly lower returns in January: its January Sharpe ratio is –0.89 versus a non-January Sharpe ratio of 0.54.

evidence that illiquidity, size, value, and volatility premiums exist in the OTC markets. Only the OTC illiquidity premium is significantly larger than its listed counterpart.

E. OTC Market Returns

The last rows in Panels A to C of Table 4 report time-series regressions using the excess return on the value-weighted OTC market as the dependent variable. The alpha of the OTC market is negative, regardless of which listed factor model is used (also see Eraker and Ready (2010)). In addition, the listed CAPM explains only 43.5% of the variation in the OTC market, while the five-factor model explains 57.3% and leaves 42.7% unexplained. This is broadly consistent with the inability of the other systematic listed factors to explain much of the variation in the OTC size, value, momentum, illiquidity, and volatility factors.

Motivated by the differences in volatility and liquidity between OTC and listed stocks in Table 3, we explore the empirical relationship between the OTC market premium and the OTC volatility and illiquidity premiums. In an untabulated regression, we find that the OTC market has highly significant loadings on the OTC volatility and *PNT* factors with *t*-statistics of 3.85 and –5.98, respectively. Moreover, after controlling for these two factors, the OTC market's alpha changes from –0.74% to 0.01% (i.e., near zero). This regression establishes strong links between the OTC volatility and illiquidity premiums and the negative OTC market premium.

F. Multivariate Cross-sectional Regressions

We also estimate return premiums using monthly multivariate linear regressions that allow us to simultaneously control for firms' betas and characteristics. Table 5 reports Fama and MacBeth (1973) return predictability coefficients, along with Newey and West (1987) standard errors in parentheses. The point estimate is the weighted-average of monthly coefficients, where each coefficient's weight is the inverse of its squared monthly standard error as in Ferson and Harvey (1999). As before, we use the GRW method in Asparouhova, Bessembinder, and Kalcheva (2010) to correct for bid-ask bounce bias. We group regressors into firms' betas on the MKT, SMB, HML, and UMD factors and firms' characteristics based on size, book-to-market equity, volatility, past returns, and illiquidity.[25] Regressions I, II, and III include only betas, only characteristics, and both betas and characteristics, respectively. In the Appendix, we explain how we estimate firms' betas and adjust them to account for nonsynchronous trading. The three sets of columns in Table 5 represent estimates of return premiums in the OTC, comparable listed, and eligible listed samples.

[Insert Table 5 here.]

There are two main findings from Table 5. First, firms' betas do not strongly predict returns in any of the three samples, especially in Regression III which includes both firms' betas and characteristics.[26] A corollary is that controlling for firms' betas has virtually no impact on the coefficients on firms' characteristics, which are nearly identical in Regressions II and III. The weak predictability from betas indicates that most of the predictive power in the cross section comes from characteristics, and supports our use of characteristics in constructing portfolios.

Second, with few exceptions, jointly estimating return premiums on firms' betas and characteristics results in premiums that are quite similar to those using portfolio methods. For example, the *PNT* coefficient in the OTC sample in Regression III is 4.053, which implies a 3.36% per month (= 4.053 · (0.08 – 0.91)) difference in returns for firms ranked at the 10th and

[25] Regression specifications I and II also include an unreported dummy variable for firms with missing or negative book equity variable to keep these firms in the sample without affecting the coefficient on book-to-market equity.
[26] Although using estimated betas as regressors induces an attenuation bias in the coefficients on betas, this bias cannot explain why half of the beta coefficients are negative and statistically significant in Regression I.

90th percentiles of *PNT*. This magnitude closely matches the top-to-bottom quintile difference in the GRW returns of *PNT* portfolios of 2.92% per month in Table 4.B. The same qualitative result applies to the other return premiums. These findings in Table 5 show that none of the return premiums estimated using univariate portfolio sorts in Table 4 is due to the correlations among firm characteristics. This makes sense in light of the low cross-correlations among the variables reported in Table 3.C. Consequently, we focus on portfolio tests in the rest of the paper.

V. Testing Theories of Return Premiums

We exploit the differences in the OTC and listed markets and their corresponding return premiums to test theories of expected returns. Our main strategy is to contrast return premiums in subsamples of OTC and listed stocks, and we use additional tests to shed further light on the illiquidity and momentum premiums.

A. Evidence from Double Sorts

We measure return premiums within each market in subsamples of stocks sorted by the characteristics that distinguish OTC and listed markets: institutional holdings, disclosure, and size. We judiciously choose these three characteristics to construct powerful tests of competing theories of return premiums. Each distinguishing characteristic is the basis for the formation of double-sorted portfolios. First, we rank stocks into terciles based on a distinguishing characteristic, such as institutional holdings, in month $t - 1$ and sort them into portfolios.[27] Within each tercile, we then sort stocks again into terciles based on the characteristics, such as liquidity, used in constructing the return premiums. Our analyses focus on the stocks in the top

[27] We group stocks into terciles rather than the standard quintiles to ensure that we have a sufficient number of stocks in the double sorted portfolios. For the two binary variables (*InstHold* and *Disclose*), we sort stocks into two portfolios based on their values to ensure sufficient numbers of stocks in each portfolio.

and bottom (i.e., extreme) terciles of these two sorts. Holding each distinguishing characteristic (e.g., institutional holdings) constant, we measure return premiums (e.g., liquidity) as the difference between returns in month *t* of stocks in the top and bottom terciles of the second tercile sort. This procedure highlights the return differences in the second dimension, liquidity, among stocks with different risk characteristics from the first sort, institutional holdings. We also measure the difference in return premiums across terciles from the first sort to test whether premiums differ across subsets of stocks within each market—e.g., the differences in returns between liquid and illiquid stocks among stocks held or not held by institutions in OTC stocks.

Table 6 shows the raw returns from these double-sorted portfolios. Panel A shows that the return premiums for illiquidity (both *PNT* and *Volume*) and size are much larger within OTC stocks that are not held by institutions. Panel B shows that the return premium for volatility is more than twice as large among OTC stocks that do not disclose book equity—and a qualitatively similar effect is observed among comparable listed stocks. Panel C indicates that the OTC premium for illiquidity is larger among small stocks, while the OTC premium for momentum is four times larger among big stocks. We now discuss the implications of these results and others for theories of return premiums.

[Insert Table 6 here.]

B. Testing Theories of Investor Disagreement and Attention

We first consider the hypothesis that short sales constraints and differences in opinion lead to overpricing and negative abnormal returns, as in theories such as Miller (1977). This idea could help explain the illiquidity, size, volatility, and value premiums in OTC and listed markets if one interprets these characteristics as proxies for investor disagreement and attention. Miller

(1977) proposes that investors disagree more about firms with high liquidity, volatility, and valuation, while numerous researchers posit that investors pay more attention to large firms.

If retail (institutional) investors are more (less) likely to disagree and have limited attention, stocks not held by institutions should exhibit higher return premiums based on proxies for disagreement and attention. A complementary story is that a lack of institutional ownership could be a proxy for short sales constraints, as suggested by Nagel (2005), which are associated with larger overpricing in Miller's (1977) theory.[28] Consistent with both interpretations, Panel A in Table 6 shows that the return premiums for illiquidity (both *PNT* and *Volume* measures), volatility, value, and size are 0.96% to 4.39% per month larger in OTC stocks that are not held by institutions. The differences in the illiquidity and size premiums are especially large and highly statistically significant. Hinting at a role for short sales constraints, the premiums among non-held stocks arise mainly from the extremely negative returns of stocks with high liquidity, size, volatility, and valuation. There are also significant differences in the liquidity (*PNT* and *Volume*) premiums between stocks held and not held by institutions in the comparable listed sample, suggesting similar mechanisms may be at work in listed markets.

The impact of differences in opinion and attention should be especially strong among OTC stocks that do not disclose basic financial information. Investors are likely to hold widely divergent views about the financial condition of firms without disclosures, suggesting overpricing of such firms' stocks could be more severe. Consistent with this idea, Panel B in Table 6 shows that the return premiums based on four proxies for disagreement and attention—*PNT*, volume, volatility, and size—are 1.38% to 1.64% per month larger among OTC stocks that do not disclose book equity. The differences in all premiums except for size are significant at the 5% level. The difference in size premiums is significant at the 10% level.

[28] Institutions, such as mutual funds, are the primary lenders of shares to short sellers in listed stocks.

We can further test disagreement theories by analyzing whether disclosure itself can predict returns. If the disclosure of financial information helps to resolve investor disagreement, as Miller (1977) suggests, disclosing firms will be less overpriced than non-disclosing firms and thus earn higher returns.[29] We look for a disclosure premium within firms in the top terciles of liquidity and volatility, where disagreement could significantly affect investors' valuations. Panel B of Table 6 shows that disclosing firms do exhibit higher returns than non-disclosing firms, especially among liquid and volatile firms. The disclosure premium is 1.52%, 1.78%, and 1.37% per month, respectively, when evaluated within the *PNT*, volume, and volatility terciles representing the most liquid and volatile firms. All three premiums are statistically significant, economically large, and in line with Miller's theory.

Furthermore, the negative market returns on OTC stocks are consistent with Miller's overpricing argument. Investor disagreement can cause overpricing of the entire market when there are market-wide short sales constraints (*e.g.*, Jarrow (1980)). Because few OTC stocks can be shorted and there is no tradeable index of OTC stocks that can be shorted (or even purchased), short sales constraints may apply to the OTC market as a whole. Thus, disagreement combined with short sales constraints could account for the overall negative returns of the OTC market. It could also help explain the strong empirical links between the OTC market premium and the OTC premiums for illiquidity and volatility, which could all stem from the same underlying cause—namely, investor disagreement.

Lastly, Miller's (1977) theory could help explain why the coefficients on market beta are negative and statistically significant in predicting returns in Table 5. He argues that "the riskiest

[29] Hirshleifer and Teoh (2003) develop a theory of attention that makes a similar prediction. Firms can choose whether to disclose financial information to investors with limited attention. In equilibrium, firms do not disclose if they have negative news, knowing that investors fail to take this self-selection into account. This theory predicts that investors overprice firms that do not disclose, implying that these firms have lower returns than disclosing firms.

stocks are also those about which there is the greatest divergence of opinion." If so, in the presence of short sales constraints, stocks with the highest systematic risk (i.e., beta) could become so overpriced that they exhibit lower future returns than stocks with low risk.

C. Testing Theories of Rational Compensation for Trading Costs

We now test alternatives to disagreement theories of OTC and listed return premiums to evaluate their explanatory power. We emphasize theories that could explain illiquidity and momentum premiums because these premiums differ so much across OTC and listed markets.

The high premium for illiquidity in OTC markets could arise because illiquid stocks are priced at a discount to compensate rational investors for their expected trading costs. In Amihud and Mendelson's (1986) model, the least liquid stocks are held in equilibrium by investors with the longest horizons, who expect to incur the fewest trading costs and thus require the lowest compensation for illiquidity.[30] This theory's key prediction is that the premium for illiquidity is lower among groups of less liquid stocks. This prediction is, however, inconsistent with the evidence in Table 4, which shows that OTC markets—despite their lower liquidity—exhibit much larger illiquidity premiums than listed markets. In addition, this prediction is inconsistent with the results in Table 6, which shows that OTC illiquidity premiums are actually larger in stocks with low disclosure—again, even though these stocks tend to be the least liquid.

Nevertheless, we test two further within-market implications of this theory because of its intuitive appeal. We first conduct univariate portfolio sorts based on illiquidity (namely, *PNT*) to test whether there is a concave (and increasing) relationship between illiquidty and returns within OTC stocks, as predicted by Amihud and Mendelson (1986). In the tests reported in Table 7, we

[30] Other rational explanations for liquidity premiums include Diamond and Verrecchia (1991), Huang (2003), and Acharya and Pedersen (2005).

refine the quintile sorts in Table 4 to decile sorts to evaluate the functional form of the relationship between illiquidity and returns. The refined sort results in portfolios with fewer than 10 firms in the early years when volume data are limited, so Table 7 only includes data from August 1995 through December 2008. The illiquidity-return relationship is approximately linear in contrast with the concave theoretical prediction. Formally, we test for concavity using the difference in the difference of the monthly returns of portfolios in deciles 10 and 7 (1.66%) as compared to deciles 4 and 1 (1.90%). The difference in difference is economically small at 0.25% per month and is statistically insignificant. This is further evidence that trading costs cannot explain the much larger illiquidity premium in OTC markets.

[Insert Table 7 here.]

We perform one additional test to see whether trading costs in OTC stocks can plausibly explain the magnitude of the high OTC illiquidity premium. We compare the after-cost returns on *long* positions in the top and bottom quintile illiquidity (*PNT*) portfolios for an investor who *demands* liquidity in every transaction. That is, the investor pays the stock's bid-ask spread on each round-trip trade. Table 8 reports summary statistics on the difference between the gross returns (before spreads) and net returns (after spreads) of these two portfolios at rebalancing frequencies of 1, 2, 3, 6, 12, and 24 months.[31] It also shows the monthly portfolio turnover and the bid-ask spreads of firms in the top and bottom *PNT* quintiles.[32]

[Insert Table 8 here.]

The main finding is that an investor who demands liquidity once per month would obtain much higher net returns (by 4.20% per month) from buying the *liquid* OTC firms; but an investor

[31] We rebalance the portfolios at *n*-month frequencies using the Jegadeesh and Titman (1993) method in which 1/*n* of the firms in each portfolio can change in each month based on rankings of firms' *PNT* values in the prior month.
[32] Because limited spread data are available, this exercise uses only the second half of the sample (1993 to 2008) and estimates costs based on average portfolio turnover multiplied by average bid-ask spreads.

who demands liquidity once every six months would obtain higher net returns (by 1.43%) from buying *illiquid* OTC firms. If an investor demands liquidity at a horizon between two and three months, the magnitude of the trading costs exactly offsets the gross return of the *PNT* factor—*i.e.*, *PNT* returns net of the difference in spreads are zero. Yet, based on the equal-weighted monthly turnover of 5.2% for the entire OTC market, a typical OTC investor horizon is 19 months (19 = 1 / 0.052). The implied horizon of OTC investors in high *PNT* firms is even longer because these firms are traded less often. This exercise suggests that the magnitude of the *PNT* factor could represent compensation for illiquidity only if the typical OTC investor needs liquidity extremely frequently relative to investors' observed holding periods. Based on these estimates, the average OTC illiquidity premium is too large to be compensation for trading costs.

However, the last column in Table 8 shows that trading costs could deter an arbitrageur from using a *long-short* strategy to exploit the high *PNT* premium. If this trader uses market orders and pays the bid-ask spread on *both* the top and bottom *PNT* portfolios, she would make only 0.08% per month at a rebalancing frequency of six months. Thus, trading costs might explain why the OTC illiquidity premium persists, though they cannot explain why it arises in the first place.

D. Testing Theories of Momentum

Firms traded in OTC markets disclose much less information than those in listed markets, and retail investors dominate in OTC markets. This suggests that theories emphasizing how investors react to information and the role of institutions could explain the relatively small OTC momentum premium. This section presents evidence that is most consistent with Hong and Stein's (1999) model of momentum based on the gradual diffusion of information.

Two elements in Hong and Stein's (1999) model are necessary for momentum. First, there must be a group of "newswatcher" investors who only attend to firms' fundamentals and disregard firms' stock price movements. Such newswatchers may not exist for many OTC firms. Greenstone, Oyer, and Vissing-Jorgensen (2006) argue that investors view financial information disclosed by most OTC firms as less credible than information from listed firms. In contrast, OTC firms' stock prices are reliable, verifiable, and widely available. If OTC stocks lack newswatchers, they would not exhibit momentum. This argument is consistent with the evidence in Tables 4 and 5 showing that OTC momentum is on average lower than listed momentum.

The second key element in Hong and Stein's (1999) model is the gradual transmission of information across newswatchers. The model predicts that momentum is stronger and longer-lasting when information transmission is slower. Because fewer investors hold and discuss OTC stocks, information transmission is likely to be slower in OTC stocks than in listed stocks. This reasoning suggests momentum should be quite strong and continue for a long time among OTC stocks that newswatchers might follow, such as large OTC firms and those that disclose key financial information. Consistent with this prediction, Panels B and C of Table 6 shows that the momentum premium is two to four times higher among OTC stocks that newswatchers might follow. Specifically, momentum is 1.78% and 1.55% per month among the largest OTC firms and those that disclose book equity, respectively, while it is only 0.41% and 0.61% among the smallest OTC firms and those that do not disclose book equity.

Next we investigate the time horizon of momentum in OTC markets. We construct long-short momentum portfolios at various time horizons using the Jegadeesh and Titman (1993) method, similar to the rebalanced portfolios examined in Table 6.[33] Table 9 reports the

[33] This procedure entails two steps. First, we form top and bottom quintile portfolios based on stocks' momentum (*Ret*[-12,-2]) as of month $t - k$. Second, to measure returns n years after portfolio formation in each month t, we

momentum portfolios' GRW and VW returns at horizons up to five years. Notably, there is no momentum (–0.08% per month) at the one-year horizon in OTC markets using the GRW method (which is simply equal weighting correcting for bid-ask bounce). There is, however, significant one-year momentum (1.57% per month) in the VW OTC portfolios, which place extremely large weights on big OTC firms. Table 6 shows that one-month momentum in big OTC firms is more than quadruple that of small OTC firms, which is consistent with the relative magnitudes of the Month 1 returns from the GRW and VW methods shown in Table 9.

[Insert Table 9 here.]

Importantly, Table 9 shows that VW momentum portfolios in OTC markets continue to exhibit positive returns at horizons up to five years. In addition, momentum in listed markets exhibits limited reversal at the five-year horizon.[34] The lack of long-term reversal of momentum in OTC and listed markets helps us differentiate theories of momentum. In the models of Hong and Stein (1999) and Barberis, Shleifer, and Vishny (1998), momentum originates from investors' underreaction to tangible firm-specific information, such as news about firm earnings.[35] In contrast, in Daniel, Hirshleifer, and Subrahmanyam's (1998) theory momentum arises from "continuing overreaction" to intangible information. The lack of reversal lends support to the two underreaction theories of momentum (Hong and Stein (1999) and Barberis, Shleifer, and Vishny (1998)). In years 2 through 5 after portfolio formation, VW OTC momentum portfolios experience average returns of positive 0.45% per month. The longer-

---

apply GRW weights to the 12 monthly returns of the extreme quintile portfolios formed in months $t - n*12$ to $t - n*12 - 11$. The top minus the bottom quintile portfolio return is the momentum premium at the n-year horizon.

[34] Lee and Swaminathan (2000) and Jegadeesh and Titman (2001) show that momentum in listed stocks partially reverses in their samples. Table 9 illustrates that this reversal effect is not present among comparable-sized listed stocks during our period. In addition, we find only weak evidence of reversal in the full set of eligible listed stocks.

[35] Because we lack earnings data on OTC firms, we cannot test the predictions of the Barberis, Shleifer, and Vishny (1998) model, which is based on a representative investor's underreaction and overreaction to sequences of news. However, Loh and Warachka (2012) argue that listed stock price reactions to sequences of earnings surprises are inconsistent with this model.

lasting high returns of the VW OTC momentum (versus VW listed momentum) portfolios is consistent with the slower transmission of information in OTC markets.

An alternative explanation for the weak GRW momentum premium in OTC markets is the small role of institutional investors in OTC markets. In listed stock markets, institutions herd (e.g., Nofsinger and Sias, 1999; Sias, 2004) and institutions follow momentum strategies (e.g., Badrinath and Wahal, 2002; Griffin, Harris, and Topaloglu, 2003). Gutierrez and Pirinsky (2007) and Vayanos and Woolley (2012) argue that momentum in listed markets partly arises because of agency issues in these delegated institutional money managers. Our cross-market evidence is broadly consistent with this view. Table 4 shows that momentum is three times higher among comparable listed stocks, which are far more likely to be held by institutions (see Table 3).

However, our within-market evidence is ostensibly inconsistent with the theory that institutions cause momentum. Panel A in Table 6 shows that OTC stocks experience nearly identical momentum (1.97% versus 2.18% per month) whether or not they are held by institutions. Nevertheless, the types of institutions likely differ across OTC and listed markets. While large asset managers play important roles in listed markets, Table 3 shows that few large institutions invest in OTC stocks. However, small hedge funds without reporting obligations could significantly affect OTC market prices. Future theories on institutional investors and momentum should account for the different roles played by these various types of investors.

VI. Concluding Discussion

While many cross-sectional return premiums in listed markets, such as size, value, and volatility, generalize to OTC markets, other return premiums are strikingly different. The premium for illiquidity in OTC markets is several times larger than in listed markets. The pronounced momentum effect in listed markets is economically small in OTC markets. Listed return factors cannot explain the majority of the variation in OTC return factors.

Variation in the illiquidity, size, value, and volatility premiums within OTC markets is consistent with theories in which disagreement and short sales constraints cause temporary overpricing. Variation in the momentum premium within OTC markets is most consistent with Hong and Stein's (1999) theory based on the gradual diffusion of information. We test and find only limited support for several alternative explanations of these premiums, including theories based on exposures to systematic factor risk and those based on transaction costs.

The return premiums that exist in OTC markets may offer insights into the future of listed markets. For example, the finding that size, value, and volatility premiums exist in OTC markets provides new evidence that these premiums are robust to differences in market structure and liquidity, and therefore could persist in the future. The finding that the illiquidity premium is strong in OTC markets and relatively weak in listed markets could have predictive value, too. Although listed markets are usually far more liquid than OTC markets, they occasionally succumb to a liquidity crisis. In these times, listed firms' disclosures could fail to resolve investor uncertainty about fundamentals, creating market conditions of unusually low transparency and liquidity much like OTC markets. During such crises, the prediction from OTC markets is that the stock prices of listed firms, particularly less transparent firms such as banks, will incorporate an illiquidity discount. This prediction matches anecdotal evidence from liquidity crises and presents a promising avenue for future research.

Appendix: Estimating Betas and Accounting for Nonsynchronous Trading

To estimate a stock's betas in month *t* on return factors, we use a time series regression of the stock's monthly return on the monthly return factors from month $t - 24$ to month $t - 1$. In cases in which a stock is not traded for one month or longer, we cumulate monthly factors during the entire non-trading period to align the stock and factor returns. We compute stocks' betas on the MKT, SMB, and HML factors using the three-factor Fama and French (1993) regression. We compute betas with respect to the UMD momentum factor constructed by Kenneth French, which was originally used by Carhart (1997), and the illiquidity factor (ILQ) of Pastor and Stambaugh (2003) using regressions of returns on MKT, SMB and HML in addition to the respective factor. We require at least 10 observations in each regression.

Because many OTC stocks do not trade every day, we correct stocks' raw betas for nonsynchronous trading by extending the method in Lo and MacKinlay (1990). Suppose that the unobservable, "true" return process for stock *i* is

$$R_{it} = \alpha_i + F_t \beta_i + \varepsilon_{it} \tag{1}$$

where F_t is a $1 \times m$ vector of factor returns. The econometrician only observes prices and returns in periods when trading occurs. We denote the probability that stock *i* does not trade by p_i and assume this probability is constant across periods. If a security does not trade for several periods, the observed return when it eventually does trade is the sum of all unobserved true returns per period. Formally, we define a variable $X_{it}(k)$ as follows:

$$X_{it}(k) = \begin{cases} 1 & \text{if stock } i \text{ traded in period t but did not trade in all } k \text{ period prior to } t \\ 0 & \text{otherwise.} \end{cases} \tag{2}$$

This definition implies that $X_{it}(k) = 1$ with probability $(1 - p_i) p_i^k$. Now we can write the observed return process (R_{it}^o) as

$$R_{it}^{o} = \sum_{k=0}^{\infty} X_{it}(k) R_{it-k}. \tag{3}$$

We assume that factor returns (F_t) are independent and identically distributed over time with $E(F_t) = \mu_F$ and

$$Var(F_t) = \Sigma_f = \begin{pmatrix} \sigma_1^2 & . & . & . & \sigma_{1m} \\ . & . & & & . \\ . & & . & & . \\ . & & & . & . \\ \sigma_{m1} & . & . & . & \sigma_m^2 \end{pmatrix}. \tag{4}$$

We estimate regressions of observed monthly returns on observed monthly factors. The observed beta vectors that we estimate are

$$\beta_i^o = [E(F_t^{o'} F_t^o) - E(F_t^{o'})E(F_t^o)]^{-1}[E(F_t^{o'} R_{it}^o) - E(F_t^{o'})E(R_{it}^o)]. \tag{5}$$

Simplifying and rearranging Equation (5) yields a relation between stock i's true beta and its observed beta and alpha:

$$\beta_i = \beta_i^o - \frac{2p_i}{1-p_i}\alpha_i^o[1 - \frac{2p_i}{1-p_i}\mu_f(\Sigma_f + \frac{2p_i}{1-p_i}\mu_f^{'}\mu_f)^{-1}\mu_f^{'}]^{-1}(\Sigma_f + \frac{2p_i}{1-p_i}\mu_f^{'}\mu_f)^{-1}\mu_f^{'}. \tag{6}$$

When F_t is a scalar, such as an intercept in a factor regression, this formula simplifies to

$$\beta_i = \beta_i^o - \frac{2p_i}{1-p_i}\alpha_i^o \frac{\mu_F}{\sigma_F^2}. \tag{7}$$

We obtain the parameters required for computing β_i as follows. First, we estimate the observed betas and alphas (β_i^o and α_i^o) for each firm for each month with regressions using the 24 previous months. Next, we estimate the factor means and covariances (μ_F and Σ_f) for each regression during the same 24 months. Lastly, we estimate the probability of a stock not trading p_i using the proportion of months in which the stock did not trade during the regression period. We then substitute these parameter estimates into Equation (7) to estimate stock i's true beta.

References

Acharya, V. V. and L. H. Pedersen, 2005, Asset Pricing with Liquidity Risk, *Journal of Financial Economics* 77, 375-410.

Aggarwal, R. K., and G. Wu, 2006, Stock Market Manipulation: Theory and Evidence, *Journal of Business* 79, 1915−1953.

Amihud, Y., 2002, Illiquidity and Stock Returns: Cross-Section and Time-Series Effects, *Journal of Financial Markets* 5, 31−56.

Amihud, Y. and H. Mendelson, 1986, Asset Pricing and the Bid-Ask Spread, *Journal of Financial Economics* 17, 223−249.

Ang, A., R. J. Hodrick, Y. Xing, and X. Zhang, 2006, The Cross-Section of Volatility and Expected Returns, *Journal of Finance* 61, 259−299.

Asness, C. S., T. J. Moskowitz, and L. H. Pedersen, 2012, Value and Momentum Everywhere, forthcoming *Journal of Finance*.

Asparouhova, E., H. Bessembinder, and I. Kalcheva, 2010, Liquidity Biases in Asset Pricing Tests, *Journal of Financial Economics* 96, 215−237.

Badrinath, S. G. and S. Wahal, 2002, Momentum Trading by Institutions, *Journal of Finance* 57, 2449−2478.

Banz, R. W., 1981, The Relationship Between Return and Market Value of Common Stocks, *Journal of Financial Economics* 9, 3−18.

Barber, B. M., and T. Odean, 2000, Trading Is Hazardous to Your Wealth: The Common Stock Investment Performance of Individual Investors, *Journal of Finance* 55, 773−806.

Barber, B. M., and T. Odean, 2008, All That Glitters: The Effect of Attention and News on the Buying Behavior of Individual and Institutional Investors, *Review of Financial Studies* 21, 785−818.

Barberis, N., A. Sheifer, and R. Vishny, 1998, A Model of Investor Sentiment, *Journal of Financial Economics* 49, 307−343.

Baruch, S., G. A. Karolyi, and M. L. Lemmon, 2007, Multimarket Trading and Liquidity: Theory and Evidence, *Journal of Finance* 62, 2169−2200.

Baruch, S., and G. Saar, 2009, Asset Returns and the Listing Choice of Firms, *Review of Financial Studies* 22, 2239−2274.

Bekaert, G., C. Harvey, and C. Lundbland, 2007, Liquidity and Expected Returns: Lessons from Emerging Markets, *Review of Financial Studies* 20, 1783−1831.

Blume, M. E., and R. F. Stambaugh, 1983, Biases in Computed Returns: An Application to the Size Effect, *Journal of Financial Economics* 12, 387−404.

Böhme, R., and T. Holz, 2006, The Effect of Stock Spam on Financial Markets, working paper, Technische Universität Dresden.

Bushee, B. J., and C. Leuz, 2005, Economic Consequences of SEC Disclosure Regulation: Evidence from the OTC Bulletin Board, *Journal of Accounting and Economics* 39, 233−264.

Carhart, M. M., 1997, On Persistence in Mutual Fund Performance, *Journal of Finance* 52, 57−82.

Daniel K., D. Hirshleifer, and A. Subrahmanyam, 1998, Investor Psychology and Security Market Under- and Overreactions, *Journal of Finance* 53, 1839−1885.

Diamond, D. W. and R. E. Verrecchia, 1991, Disclosure, Liquidity, and the Cost of Capital, *Journal of Finance* 46, 1325−1359.

Dimson, E., 1979, Risk Measurement when Shares Are Subject to Infrequent Trading, *Journal of Financial Economics* 7, 197−226.

Eraker, B., and M. J. Ready, 2010, Over the Counter Stock Markets, working paper, University of Wisconsin, Madison.

Fama, E. F. and K. R. French, 1992, The Cross-Section of Expected Stock Returns, *Journal of Finance* 47, 427−465.

Fama, E. F. and K. R. French, 1993, Common Risk Factors in the Returns on Stocks and Bonds, *Journal of Financial Economics* 33, 3−56.

Fama, E. F. and J. D. MacBeth, 1973, Risk, Return, and Equilibrium: Empirical Tests, *Journal of Political Economy* 81, 607−636.

Fang, L. and J. Peress, 2009, Media Coverage and the Cross-Section of Stock Returns, *Journal of Finance* 64, 2023-2052.

Ferson, W. E. and C. R. Harvey, 1999, Conditioning Variables and the Cross Section of Stock Returns, *Journal of Finance* 54, 1325−1360.

Frieder, L. and J. Zittrain, 2007, Spam Works: Evidence from Stock Touts and Corresponding Market Activity, working paper, Purdue University.

Greenstone, M., P. Oyer, and A. Vissing-Jorgensen, 2006, Mandated disclosure, stock returns, and the 1964 Securities Acts Amendments, *Quarterly Journal of Economics* 121, 399−460.

Griffin, J. M., J. H. Harris, and S. Topaloglu, 2003, The Dynamics of Institutional and Individual Trading, *Journal of Finance* 58, 2285−2320.

Gutierrez, R. C. and C. Pirinsky, 2007, Momentum, Reversal, and the Trading Behaviors of Institutions, *Journal of Financial Markets* 10, 48−75.

Harris, J. H., V. Panchapagesan, and I. Werner, 2008, Off but Not Gone: A Study of NASDAQ Delistings, SSRN working paper.

Hasbrouck, J., 2009, Trading Costs and Returns for U.S. Equities: Estimating Effective Costs from Daily Data, *Journal of Finance* 64, 1445−1477.

Hirshleifer, D., and S. H. Teoh, 2003, Limited Attention, Information Disclosure, and Financial Reporting, *Journal of Accounting Economics* 36, 337−386.

Hong, H. and J. C. Stein, 1999, A Unified Theory of Underreaction, Momentum Trading, and Overreaction in Asset Markets, *Journal of Finance* 54, 2143−2184.

Huang, M., 2003, Liquidity Shocks and Equilibrium Liquidity Premia, *Journal of Economic Theory* 109, 104−129.

Huberman, G. and T. Regev, 2001, Contagious Speculation and a Cure for Cancer: A Nonevent that Made Stock Prices Soar, *Journal of Finance* 56, 387−396.

Ince, O. S. and R. B. Porter, 2006, Individual Equity Return Data from Thomson Datastream: Handle with Care, *Journal of Financial Research* 29, 463−479.

Jarrow, R., 1980, Heterogeneous Expectations, Restrictions on Short Sales, and Equilibrium Asset Prices, *Journal of Finance* 35, 1105−1113.

Jegadeesh N. and S. Titman, 1993, Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency, *Journal of Finance* 48, 65−91.

Jegadeesh N. and S. Titman, 2001, Profitability of Momentum Strategies: An Evaluation of Alternative Explanations, *Journal of Finance* 56, 699−720.

Karolyi, G. A., and A. B. Sanders, 1998, The Variation of Economic Risk Premiums in Real Estate Returns, *Journal of Real Estate Finance and Economics*, 17, 245-262.

Lee, C. M. C. and B. Swaminathan, 2000, Price Momentum and Trading Volume, *Journal of Finance* 55, 2017−2069.

Lesmond, D. A., J. P. Ogden, and C. A. Trzcinka, 1999, A New Estimate of Transaction Costs, *Review of Financial Studies* 12, 1113−1141.

Leuz, C., A. Triantis, and T. Y. Wang, 2008, Why Do Firms Go Dark? Causes and Economic Consequences of Voluntary SEC Deregistrations, *Journal of Accounting and Economics* 45, 181−208.

Lo, A. W. and A. C. MacKinlay, 1990, An Econometric Analysis of Nonsynchronous Trading, *Journal of Econometrics* 45, 181−211.

Loh, R. K. and M. Warachka, 2012, Streaks in Earnings Surprises and the Cross-Section of Stock Returns, *Management Science*, forthcoming.

Macey, J. R., M. O'Hara, and D. Pompilio, 2008, Down and Out in the Stock Market: The Law and Economics of the Delisting Process, *Journal of Law and Economics* 51, 683−713.

Miller, E. M., 1977, Risk, Uncertainty, and Divergence of Opinion, *Journal of Finance* 32, 1151−1168.

Merton, R. C., 1987, A Simple Model of Capital Market Equilibrium with Incomplete Information, *Journal of Finance* 42, 483−510.

Nagel, S., 2005, Short Sales, Institutional Investors and the Cross Section of Stock Returns, *Journal of Financial Economics*, 78, 277-309.

Newey, W. K. and K. D. West, 1987, A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix, *Econometrica* 55, 703−708.

Newey, W. K. and K. D. West, 1994, Automatic Lag Selection in Covariance Matrix Estimation, *Review of Economic Studies* 61, 631−653.

Nofsinger, J. R. and R. W. Sias, 1999, Herding and Feedback Trading by Institutional and Individual Investors, *Journal of Finance* 54, 2263−2295.

Pastor, L. and R. F. Stambaugh, 2003, Liquidity Risk and Expected Stock Returns, *Journal of Political Economy* 111, 642−658.

Scheinkman, J. A. and W. Xiong, 2003, Overconfidence and Speculative Bubbles, *Journal of Political Economy* 111, 1183−1220.

Sias, R. W., 2004, Institutional Herding, *Review of Financial Studies* 17, 165−206.

Vayanos, D., and P. Woolley, 2012, An Institutional Theory of Momentum and Reversal, working paper, London School of Economics.

Table 1: Summary Statistics for the OTC and Listed Samples in July 1997

We report statistics for size, volume, and the number of firms in the OTC, comparable listed, and eligible listed samples in July of 1997, a typical month in terms of our OTC sample size. We construct the comparable listed sample to have the same median size as the OTC sample. The eligible listed sample consists of all listed stocks that satisfy the same data requirements as the OTC stocks in our sample, as described in Section I.B.

	OTC	Comparable Listed	Eligible Listed
Total Market Capitalization (Billions)	21.3	15.1	9,592
Median Market Capitalization (Millions)	12.9	12.9	36
Mean Market Capitalization (Millions)	35.5	12.7	1,346
Trading Volume (Annualized Billions)	8.2	15.2	11,472
Median Trading Volume (Annualized Millions)	2.3	6.1	101
Mean Trading Volume (Annualized Millions)	13.7	12.8	1,608
Number of Firms	600	1,190	7,127

Table 2: The Peak Sizes of the Largest 10 OTC Firms

This table describes the ten largest OTC firms in our sample from 1977 to 2008. The first column shows the month in which each firm attains its peak size. The third column shows its size in that month. The two rightmost columns show each OTC firm's size rank and percentile within the eligible listed sample. The eligible listed sample consists of all listed stocks that satisfy the same data requirements as the OTC stocks in our sample, as described in Section I.B.

Company Name	Peak Month	Trading Venue	Peak Size in Billions	Size Rank in Listed Sample	Size Percentile in Listed Sample
PUBLIX SUPER MARKETS INC	Dec-08	OTCBB	88.5	18th	99.5%
DELPHI CORP	Mar-08	Pink Sheets	13.0	225th	94.8%
MCI INC	Jan-04	Pink Sheets	7.7	292th	93.9%
MAXIM INTEGRATED PRODS INC	May-08	Pink Sheets	7.1	381th	91.2%
LEVEL 3 COMMUNICATIONS INC	Feb-98	OTCBB	6.6	297th	95.8%
NAVISTAR INTL CORP NEW	May-08	Pink Sheets	5.3	464th	89.3%
COMVERSE TECHNOLOGY INC	May-07	Pink Sheets	4.7	567th	87.6%
MERCURY INTERACTIVE CORP	Oct-06	Pink Sheets	4.6	515th	88.8%
ACTERNA CORP	Oct-00	OTCBB	3.0	623th	89.8%
HEALTHSOUTH CORP	Dec-04	Pink Sheets	2.5	734th	84.4%

Table 3: Cross-Sectional Summary Statistics for Key Variables

We summarize the distributions of monthly returns and the main firm characteristics for the OTC and comparable listed samples in Panels A and B, respectively. We construct the comparable listed sample to have the same median size as the OTC sample. Panel C contains average cross-sectional correlations between betas and characteristics among OTC sample firms. We compute all statistics below separately for the cross section of stocks in each month and then average across months. We measure all firms characteristics other than *PNT* using logarithms. We winsorize all firm characteristics at the 5% level, but we do not winsorize returns. The first seven columns report monthly averages of means, standard deviations, and various percentiles. The second to last column presents the average number of firms with non-missing values of each variable in each month. The last column presents the total number of months in which there is any data for each variable.

Panel A: OTC Stocks

	Monthly Averages								Total
Variable	Mean	SD	P5	P25	P50	P75	P95	Firms	Months
Return (%)	-0.04	28.08	-34.73	-9.95	-1.30	4.86	39.23	486	383
Disclosure	0.60	0.46	0.00	0.29	0.65	1.00	1.00	486	383
Size	2.35	1.30	0.19	1.36	2.32	3.28	4.72	486	383
B/M	1.09	2.17	0.06	0.30	0.69	1.28	3.28	231	383
Volatility	6.56	5.52	0.79	2.33	4.95	8.97	20.57	476	383
Volume	8.25	3.57	4.43	5.67	7.01	10.96	14.62	486	383
PNT	0.55	0.34	0.01	0.28	0.63	0.82	0.94	486	383
Spread	0.15	0.14	0.02	0.05	0.10	0.20	0.51	391	192
InstHold	0.26	0.41	0.00	0.00	0.00	0.47	1.00	477	344

Panel B: Comparable Listed Sample

Variable	Monthly Averages								Total
	Mean	SD	P5	P25	P50	P75	P95	Firms	Months
Return (%)	0.66	19.46	-24.45	-8.99	-1.22	7.28	32.16	1018	383
Disclosure	0.83	0.33	0.28	0.65	1.00	1.00	1.00	1018	383
Size	2.21	0.53	1.08	1.85	2.32	2.66	2.89	1018	383
B/M	1.29	1.64	0.18	0.54	0.96	1.57	3.26	789	383
Volatility	4.29	2.13	1.22	2.65	3.97	5.61	8.99	1005	383
Volume	10.77	1.98	8.11	9.48	10.27	12.35	14.26	1018	383
PNT	0.20	0.21	0.00	0.03	0.13	0.33	0.67	1018	383
Spread	0.08	0.04	0.02	0.04	0.07	0.10	0.18	538	303
InstHold	0.71	0.39	0.08	0.51	0.82	0.99	1.00	890	344

Panel C: Cross-sectional Correlations among OTC Stocks

	β_{MKT}	β_{SMB}	β_{HML}	β_{UMD}	*Size*	*B/M*	*Volatility*	*Ret[-1]*	*Ret[-12,-2]*	*PNT*	*Volume*	*Disclosure*	*InstHold*
β_{MKT}	1.00	-0.08	0.42	0.02	0.03	-0.09	0.05	-0.01	-0.02	-0.15	0.12	0.06	0.02
β_{SMB}	-0.08	1.00	0.13	-0.01	-0.04	-0.05	0.10	-0.01	0.01	-0.14	0.11	0.03	-0.03
β_{HML}	0.42	0.13	1.00	0.03	0.03	-0.04	-0.03	0.01	-0.04	-0.03	0.03	0.03	0.04
β_{UMD}	0.02	-0.01	0.03	1.00	0.06	-0.02	-0.03	-0.01	0.02	0.00	0.02	0.01	0.02
Size	0.03	-0.04	0.03	0.06	1.00	-0.19	-0.36	0.05	0.15	-0.17	0.36	0.06	0.27
B/M	-0.09	-0.05	-0.04	-0.02	-0.19	1.00	-0.03	-0.03	-0.13	0.22	-0.19	-0.22	-0.02
Volatility	0.05	0.10	-0.03	-0.03	-0.36	-0.03	1.00	0.02	-0.01	-0.06	-0.11	0.01	-0.19
Ret[-1]	-0.01	-0.01	0.01	-0.01	0.05	-0.03	0.02	1.00	-0.01	0.04	0.01	0.02	-0.01
Ret[-12,-2]	-0.02	0.01	-0.04	0.02	0.15	-0.13	-0.01	-0.01	1.00	0.00	0.05	0.04	0.00
PNT	-0.15	-0.14	-0.03	0.00	-0.17	0.22	-0.06	0.04	0.00	1.00	-0.84	-0.12	-0.06
Volume	0.12	0.11	0.03	0.02	0.36	-0.19	-0.11	0.01	0.05	-0.84	1.00	0.10	0.17
Disclosure	0.06	0.03	0.03	0.01	0.06	-0.22	0.01	0.02	0.04	-0.12	0.10	1.00	0.17
InstHold	0.02	-0.03	0.04	0.02	0.27	-0.02	-0.19	-0.01	0.00	-0.06	0.17	0.17	1.00

Table 4: Time Series Analysis of OTC and Comparable Listed Factor Portfolios

This table summarizes the returns and risk of long-short factor portfolios constructed using data on OTC stocks and comparable listed stocks from 1977 through 2008. We construct the comparable listed sample to have the same median size as the OTC sample. To construct each factor, we sort firms in each sample into quintiles at the end of each month based on the firm characteristics in the Factor column. Each factor's return for month *t* is the difference between the weighted returns of firms in the top and bottom quintiles, as ranked in month $t-1$. We use either equal weights (EW), a firm's prior month gross returns (GRW), or its prior month size (VW) when computing quintile portfolio returns.

We estimate time series regressions of the monthly factor returns on various contemporaneous listed return factors and six lags of these factors to account for non-synchronous trading. Each factor loading is the sum of the estimated coefficients on the contemporaneous factor and its six lags. The regressors in these time series regressions are either the OTC market (OTC CAPM model), the listed MKT (Listed CAPM model), or the listed MKT, SMB, HML, UMD, and ILQ (Listed 5-Factor model) return factors. The last three columns in Panel B report the intercepts from these three regressions for each factor, while the last two columns show the average factor returns. Panel C shows the factor loadings from each regression, along with the R^2 statistics. Panels D and E report the analogous statistics for the comparable listed sample. Panel A shows the ratio of the intercepts in Panels B and D to the volatilities of the factors, where all ratios have been annualized by multiplying by the square root of 12. See the text for further details and definitions. Newey and West (1987) standard errors appear in parentheses. We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively.

Table 4 Continued

Panel A: Evaluating OTC and Comparable Listed Factor Returns

	Annualized Sharpe Ratios (GRW returns)			Annualized Information Ratios (GRW returns)			
				Listed CAPM			5-Factor Model
Factor	OTC	Comparable Listed	Eligible Listed	OTC	Comparable Listed	Eligible Listed	OTC
PNT	0.91**	0.14	-0.01	1.24**	0.29	0.08	1.34**
	(0.20)	(0.19)	(0.17)	(0.19)	(0.19)	(0.24)	(0.32)
PNT_{VW}	0.66**	0.04	0.13	1.00**	0.21	0.32	1.06**
	(0.21)	(0.20)	(0.20)	(0.23)	(0.19)	(0.27)	(0.32)
Volume	-0.90**	0.07	0.15	-1.14**	0.16	0.30	-1.23**
	(0.20)	(0.18)	(0.18)	(0.20)	(0.19)	(0.24)	(0.35)
Size	-1.02**	-0.98**	0.04	-0.98**	-0.81**	0.20	-0.92**
	(0.21)	(0.20)	(0.19)	(0.19)	(0.19)	(0.21)	(0.28)
Value	0.82**	1.19**	0.53*	1.19**	1.22**	0.68**	1.00**
	(0.24)	(0.20)	(0.21)	(0.22)	(0.22)	(0.25)	(0.33)
Momentum	0.41**	1.56**	1.30**	0.54**	1.71**	1.35**	0.09
	(0.15)	(0.15)	(0.16)	(0.14)	(0.15)	(0.17)	(0.20)
Volatility	-0.55**	-0.75**	-0.64**	-0.79**	-1.08**	-1.01**	-0.50
	(0.21)	(0.20)	(0.21)	(0.19)	(0.19)	(0.20)	(0.28)
OTC Mkt_{VW}	-0.52*			-1.21**			-1.52**
	(0.23)			(0.19)			(0.26)

Table 4 Continued

Panel B: Evaluating OTC Factor Returns

	Monthly Returns		Alphas by Model (GRW returns)		
Factor	EW Returns	GRW Returns	OTC CAPM	Listed CAPM	Listed 5-Factor
PNT	2.94**	2.92**	2.22**	3.70**	3.67**
	(0.58)	(0.63)	(0.54)	(0.57)	(0.86)
PNT_{VW}	1.68**	N/A	1.01*	2.19**	2.19**
	(0.53)		(0.42)	(0.49)	(0.66)
Volume	-3.16**	-2.77**	-2.22**	-3.36**	-3.44**
	(0.56)	(0.63)	(0.59)	(0.57)	(0.99)
Size	-3.45**	-3.07**	-3.14**	-2.95**	-2.81**
	(0.56)	(0.63)	(0.76)	(0.57)	(0.85)
Value[ǂ]	1.99**	2.08**	1.77**	2.88**	2.29**
	(0.54)	(0.60)	(0.55)	(0.52)	(0.76)
Momentum	0.49	1.39**	1.28*	1.84**	0.30
	(0.43)	(0.53)	(0.60)	(0.49)	(0.69)
Volatility	-0.85	-1.87**	-1.00	-2.63**	-1.59
	(0.62)	(0.72)	(0.71)	(0.62)	(0.90)
OTC Mkt_{VW}	-0.74*	N/A	N/A	-1.32**	-1.5**
	(0.33)			(0.21)	(0.26)

Table 4 Continued

Panel C: Systematic Variation in OTC Return Factors

	Factor Loadings							R^2 by Model		
Factor	β_{OMKT}	β_{MKT_CAPM}	β_{MKT_5F}	β_{SMB}	β_{HML}	β_{UMD}	β_{LIQ}	OTC CAPM	Listed CAPM	Listed 5-Factor
PNT	-1.05**	-1.41**	-1.24**	-1.02*	0.89	-0.16	0.13	24.3%	15.3%	34.1%
	(0.25)	(0.36)	(0.36)	(0.43)	(0.57)	(0.42)	(0.39)			
PNT_{VW}	-0.90**	-1.06**	-0.88**	-0.91*	0.70	-0.03	-0.14	36.1%	27.1%	40.1%
	(0.20)	(0.25)	(0.30)	(0.40)	(0.41)	(0.31)	(0.36)			
Volume	0.86**	1.04**	0.97*	0.82	-0.75	0.16	-0.01	17.7%	11.5%	26.5%
	(0.25)	(0.36)	(0.41)	(0.47)	(0.66)	(0.45)	(0.41)			
Size	0.02	-0.36	-0.01	-1.01	0.16	-0.39	0.33	2.4%	2.6%	8.1%
	(0.31)	(0.40)	(0.50)	(0.61)	(0.67)	(0.56)	(0.51)			
Value	-0.71**	-1.19**	-0.85**	0.15	0.67	-0.54	1.00*	11.3%	9.6%	25.3%
	(0.22)	(0.28)	(0.30)	(0.39)	(0.41)	(0.43)	(0.47)			
Momentum	-0.34	-0.62	-0.22	-0.72	0.74	1.09**	0.47	3.0%	2.2%	12.0%
	(0.26)	(0.40)	(0.39)	(0.51)	(0.47)	(0.41)	(0.44)			
Volatility	1.07**	1.63**	0.87*	1.06*	-1.11	0.31	-1.38*	15.5%	8.6%	21.8%
	(0.27)	(0.40)	(0.37)	(0.42)	(0.65)	(0.50)	(0.56)			
OTC Mkt_{VW}	N/A	1.17**	1.15**	0.59**	0.00	-0.02	0.11	N/A	43.5%	57.3%
		(0.11)	(0.13)	(0.17)	(0.17)	(0.14)	(0.18)			

Table 4 Continued

Panel D: Evaluating Comparable Listed Factor Returns

	Monthly Returns		Alphas by Model (GRW returns)		
Factor	Raw Returns	GRW Returns	OTC CAPM	Listed CAPM	Listed 5-Factor
PNT	0.11	0.22	-0.01	0.40	0.07
	(0.30)	(0.30)	(0.29)	(0.26)	(0.28)
PNT_{VW}	0.06	N/A	-0.22	0.28	-0.14
	(0.31)		(0.29)	(0.25)	(0.28)
Volume	0.16	0.10	0.17	0.22	0.21
	(0.27)	(0.27)	(0.27)	(0.26)	(0.30)
Size	-1.01**	-0.98**	-1.21**	-0.79**	-0.43
	(0.19)	(0.20)	(0.24)	(0.19)	(0.25)
Value[‡]	1.39**	1.36**	1.36**	1.40**	1.40**
	(0.23)	(0.23)	(0.24)	(0.25)	(0.24)
Momentum	1.77**	2.10**	1.95**	2.23**	2.06**
	(0.21)	(0.21)	(0.20)	(0.19)	(0.28)
Volatility	-0.91*	-1.35**	-0.81*	-1.76**	-1.87**
	(0.36)	(0.36)	(0.37)	(0.30)	(0.28)

Table 4 Continued

Panel E: Systematic Variation in Comparable Listed Return Factors

	Factor Loadings							R^2 by Model		
Factor	β_{OMKT}	β_{MKT_CAPM}	β_{MKT_5F}	β_{SMB}	β_{HML}	β_{UMD}	β_{LIQ}	OTC CAPM	Listed CAPM	Listed 5-Factor
PNT	-0.28*	-0.41**	-0.20	-0.66**	0.76**	0.17	-0.05	32.9%	26.5%	56.7%
	(0.14)	(0.14)	(0.16)	(0.20)	(0.19)	(0.18)	(0.14)			
PNT_{VW}	-0.32**	-0.51**	-0.31	-0.57**	0.72**	0.29	-0.09	37.4%	31.7%	60.2%
	(0.12)	(0.14)	(0.16)	(0.21)	(0.19)	(0.17)	(0.15)			
Volume	0.01	-0.10	-0.18	0.39	-0.46*	0.10	0.01	32.6%	26.6%	58.0%
	(0.13)	(0.14)	(0.15)	(0.21)	(0.19)	(0.16)	(0.14)			
Size	-0.32**	-0.36**	-0.31*	-0.35	0.04	-0.19	-0.28	7.9%	8.0%	21.0%
	(0.10)	(0.11)	(0.14)	(0.26)	(0.22)	(0.22)	(0.15)			
Value	0.01	-0.05	0.14	-0.37**	0.49**	-0.38**	0.29	5.9%	3.4%	40.2%
	(0.09)	(0.14)	(0.12)	(0.13)	(0.15)	(0.13)	(0.15)			
Momentum	-0.20*	-0.29*	-0.29	-0.23	-0.07	0.34*	-0.10	6.4%	9.1%	35.0%
	(0.09)	(0.12)	(0.16)	(0.17)	(0.17)	(0.16)	(0.14)			
Volatility	0.69**	0.87**	0.63**	1.21**	-0.44	0.12	-0.03	34.6%	22.2%	54.9%
	(0.17)	(0.16)	(0.19)	(0.29)	(0.28)	(0.25)	(0.21)			

Table 5: Cross-Sectional Regressions of Monthly Returns on Firm Characteristics

This table displays corrected estimates of cross-sectional regressions of monthly stock returns on several firm characteristics and factor loadings. We estimate monthly cross-sectional weighted least squares regressions as in Asparouhova, Bessembinder, and Kalcheva (2010), using each stock's gross return in the previous month as the weighting. The table reports average coefficients that weight each monthly coefficient by the inverse of its squared standard errors as in Ferson and Harvey (1999). We compute Newey and West (1987) standard errors with five lags based on the formula from Newey and West (1994). The R^2 in the bottom row is the average from the monthly regressions. We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively.

	OTC Sample			Comparable Listed Sample			Eligible Listed Sample		
	I	II	III	I	II	III	I	II	III
β_{MKT}	-0.228**		-0.140*	-0.233**		-0.057	-0.282**		-0.069
	(0.063)		(0.054)	(0.072)		(0.059)	(0.086)		(0.059)
β_{SMB}	-0.160**		-0.063*	-0.128**		-0.014	-0.199**		-0.047
	(0.034)		(0.031)	(0.038)		(0.032)	(0.052)		(0.031)
β_{HML}	0.141**		0.091*	0.061		0.012	0.198**		0.054
	(0.044)		(0.042)	(0.039)		(0.028)	(0.062)		(0.034)
β_{UMD}	-0.065		-0.060	0.007		-0.005	0.047		0.028
	(0.044)		(0.041)	(0.027)		(0.026)	(0.029)		(0.023)
Size		-0.692**	-0.688**		-0.607**	-0.625**		-0.134**	-0.142**
		(0.141)	(0.124)		(0.097)	(0.095)		(0.038)	(0.038)
B/M		0.380**	0.316**		0.659**	0.631**		0.522**	0.475**
		(0.119)	(0.117)		(0.104)	(0.102)		(0.083)	(0.074)
Volatility		-0.247**	-0.245**		-0.356**	-0.347**		-0.436**	-0.414**
		(0.034)	(0.033)		(0.043)	(0.038)		(0.060)	(0.046)
Ret[-1]		-0.038**	-0.038**		-0.064**	-0.065**		-0.043**	-0.046**
		(0.007)	(0.007)		(0.006)	(0.006)		(0.005)	(0.005)
Ret[-12,-2]		0.008**	0.008**		0.018**	0.019**		0.013**	0.014**
		(0.001)	(0.001)		(0.001)	(0.001)		(0.001)	(0.001)
PNT		4.302**	4.053**		-0.364	-0.475		0.050	-0.086
		(0.642)	(0.639)		(0.334)	(0.301)		(0.373)	(0.306)
Average R^2	6.8%	10.6%	15.0%	1.6%	3.7%	4.7%	2.6%	4.8%	5.8%
Avg. Stocks	454	441	439	919	905	905	4,809	4,762	4,762

Table 6: Double Sorted Portfolios

This table contains average monthly returns for double sorted portfolios within OTC stocks and within stocks included in the comparable listed sample, which consists of stocks that are comparable to stocks in the OTC sample in terms of size, as described in Section I.C. We first rank stocks according to one characteristic of interest and sort them into portfolios. We then rank stocks within these portfolios according to other characteristics and again sort into portfolios. We sort stocks into terciles rather than quintiles to ensure that we have a sufficient number of stocks in each portfolio, and require at least 10 stocks in each tercile. Within each double-sorted tercile, we compute returns corrected for bid-ask bounce by weighing each stock's return by its prior month's gross returns. We display returns for the top and bottom terciles (i.e., the extreme terciles) according to the second sort within the first-sort extreme terciles. For binary variables (*InstHold* and *Disclose)*, we sort stocks into two portfolios based on their values.

Panel A reports the returns of double-sorted portfolios where stocks are first sorted according to *InstHold*. Panel B reports returns where stocks are first sorted according to *Disclose*. Panel C reports returns where stocks are first sorted according to *Size.*

We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively. These statistical tests employ Newey and West (1987) standard errors with five lags based on the formula from Newey and West (1994).

Panel A: Double Sorted Portfolios: Initial Sort Based on Institutional Holdings

	Held stocks monthly returns			Non-held stocks monthly returns			Premium Difference (%)	Months
	Top tercile	Bottom tercile	Premium	Top tercile	Bottom tercile	Premium		
OTC Stocks								
PNT	0.21	-1.44	1.65	1.11	-4.12	5.23**	-3.58**	172
Size	-0.31	0.40	-0.71	-2.13	1.74	-3.87**	3.16**	202
Volume	-0.80	0.51	-1.30	-3.97	1.72	-5.70**	4.39**	173
Value	1.18	-1.36	2.54**	1.10	-2.56	3.66**	-1.12	178
Momentum	0.77	-1.20	1.97**	-0.28	-2.46	2.18**	-0.21	193
Volatility	-0.76	0.52	-1.28	-2.01	0.23	-2.24**	0.96	202
Comparable Listed Stocks								
PNT	0.46	0.35	0.11	0.54	-0.28	0.82*	-0.71*	318
Size	0.17	0.90	-0.73**	-0.05	0.70	-0.75*	0.02	323
Volume	0.57	0.28	0.29	-0.18	0.53	-0.71	1.00**	323
Value	0.89	-0.03	0.92**	1.08	-0.76	1.84**	-0.92*	321
Momentum	1.23	-0.34	1.56**	1.08	-0.93	2.01**	-0.44	322
Volatility	-0.22	0.88	-1.10**	-0.67	0.98	-1.65**	0.55	322

Panel B: Double Sorted Portfolios: Initial Sort Based on Disclosure

	Disclosing stocks monthly returns			Non-disclosing stocks monthly returns			Premium Difference (%)	Months
	Top tercile	Bottom tercile	Premium	Top tercile	Bottom tercile	Premium		
OTC Stocks								
PNT	0.89	-1.04	1.94**	0.75	-2.56	3.31**	-1.38*	286
Size	-0.22	1.16	-1.38**	-1.47	1.42	-2.89**	1.51	341
Volume	-0.62	1.02	-1.64**	-2.40	0.89	-3.28**	1.64*	286
Momentum	0.89	-0.66	1.55**	-0.04	-0.65	0.61	0.94	330
Volatility	-0.24	0.70	-0.94	-1.61	0.93	-2.54**	1.60*	340
Comparable Listed Stocks								
PNT	0.69	0.36	0.33	0.41	-0.35	0.76	-0.43	286
Size	0.25	1.08	-0.83**	-0.03	0.41	-0.45	-0.38	287
Volume	0.40	0.55	-0.15	-0.15	0.35	-0.50	0.35	286
Momentum	1.45	-0.14	1.59**	1.27	-0.73	2.00**	-0.41	280
Volatility	-0.12	1.04	-1.16**	-0.90	0.89	-1.79**	0.63*	287

Panel C: Double Sorted Portfolios: Initial Sort Based on Size

	Big stocks monthly returns			Small stocks monthly returns			Premium	
	Top tercile	Bottom tercile	Premium	Top tercile	Bottom tercile	Premium	Difference (%)	Months
OTC Stocks								
PNT	0.12	-2.00	2.12*	2.31	-1.32	3.62**	-1.50	213
Volume	-1.47	-0.33	-1.14	-1.59	3.21	-4.80**	3.65**	213
Value	0.33	-2.72	3.05**	2.03	0.19	1.84	1.20	184
Momentum	-0.09	-1.86	1.78**	1.26	0.84	0.41	1.37	307
Volatility	-2.12	0.44	-2.55**	0.95	1.53	-0.58	-1.97	323
Comparable Listed Stocks								
PNT	0.31	0.10	0.21	0.77	0.83	-0.06	0.27	383
Volume	0.41	0.11	0.29	1.02	0.61	0.42	-0.12	383
Value	0.50	-0.19	0.70**	1.46	0.54	0.92**	-0.23	383
Momentum	1.08	-0.73	1.81**	1.54	0.24	1.29**	0.51*	383
Volatility	-0.72	0.78	-1.50**	0.47	1.19	-0.72*	-0.78**	383

Table 7: Liquidity Deciles

This table contains average monthly returns for liquidity decile portfolios. We rank firms based on their PNT values in each month and divide them into decile portfolios. We adjust decile cutoffs such that two firms with the same PNT value are always in the same decile portfolio. We require at least 10 firms in each decile portfolio in each month and accordingly only include data from August 1995 through December 2008, as volume data are limited prior to 1995. A decile portfolio return for month *t* is based on month *t – 1* ranking. We compute returns corrected for bid-ask bounce by weighing each firm's return by its prior month's gross returns.

The bottom three rows of this table contain the differences between the average returns of liquidity deciles 4 and 1 and liquidity deciles 10 and 7, as defined above, and the difference between these differences. We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively. These statistical tests employ Newey and West (1987) standard errors with five lags based on the formula from Newey and West (1994).

Liquidity Decile	Average Monthly Returns
1	-3.28%
2	-2.94%
3	-1.82%
4	-1.37%
5	-0.96%
6	-0.32%
7	0.22%
8	1.31%
9	0.82%
10	1.88%
Difference 10 – 1	5.16%**
Difference 4 – 1	1.90%*
Difference 10 – 7	1.66%
Difference-in-difference (4 – 1) – (10 – 7)	0.25%

Table 8: Net returns of the OTC Illiquidity Factor at Various Rebalancing Frequencies

This table compares the returns of portfolios of OTC firms ranked in the top and bottom quintiles of illiquidity (*PNT*) to the cost of trading these portfolios from the perspective of an investor who demands liquidity in every transaction. That is, the investor pays the stock's bid-ask spread on each round-trip trade. We compute summary statistics for long-short *PNT* portfolios that are rebalanced at 1, 2, 3, 6, 12, and 24 month frequencies. Portfolios are rebalanced every *n* months using the method in Jegadeesh and Titman (1993) in which up to 1/*n* of the firms in each portfolio change in each month based on rankings of OTC firms' *PNT* values in the prior month. The columns show the net returns (after spreads), gross returns (before spreads), monthly portfolio turnover, and the average bid-ask spreads in the top and bottom *PNT* quintiles. These statistics represent averages from 192 monthly of data from January 1993 through December 2008.

Rebalancing Frequency (in Months)	Gross Monthly Portfolio Return	Portfolio Turnover	Illiquid spread	Liquid spread	Return Net of Difference in Spreads	Return Net of Sum of Spreads
1	4.53%	41.87%	21.81%	7.23%	-4.20%	-8.94%
2	3.95%	24.72%	20.44%	7.09%	-0.54%	-3.38%
3	3.69%	18.50%	19.52%	6.99%	0.63%	-1.51%
6	3.14%	11.89%	17.92%	6.74%	1.43%	0.08%
12	2.74%	8.05%	16.15%	6.47%	1.73%	0.87%
24	2.24%	5.78%	14.40%	6.35%	1.61%	1.08%

Table 9: Long–term Returns of Momentum Portfolios

This table contains average returns for long-short momentum portfolios constructed at various time horizons using the method described in Jegadeesh and Titman (1993). We first form top and bottom quintile portfolios for each month *t-1* based on stocks' momentum, defined as the return from month *t-12* to month *t-2*. Returns within each extreme quintile portfolio are either weighted by the prior month's gross returns ("GRW returns") or value weighted ("VW returns"). Then, to measure momentum returns *n* years after portfolio formation in each month *t*, we equally weight the 12 monthly returns of the extreme quintile portfolios formed in months *t - n*12* to *t - n*12 – 11*. The top minus bottom quintile portfolio return is the momentum premium at the *n*-year horizon. We compute returns for portfolios within our 3 samples: OTC stocks, stocks included in the comparable listed sample, which consists of stocks that are comparable to stocks in the OTC sample in terms of size, as described in Section I.C, and stocks included in the eligible listed sample, which consists of all listed stocks that satisfy the same data requirements as the OTC stocks in our sample, as described in Section I.B. We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively. These statistical tests employ Newey and West (1987) standard errors with five lags based on the formula from Newey and West (1994).

	OTC Stocks		Comparable Listed Stocks		Eligible Listed Stocks	
Horizon in Months	GRW Returns	VW Returns	GRW Returns	VW Returns	GRW Returns	VW Returns
[1,1]	1.39**	3.15**	2.10**	1.97**	1.68**	1.29**
[1,12]	-0.08	1.57**	0.58**	0.75**	0.44*	0.47
[13,24]	-0.75	0.71	-0.12	-0.03	-0.21	-0.23
[25,36]	-0.07	0.37	0.13	0.24	-0.17	-0.11
[37,48]	-0.66	0.37	0.05	0.05	0.10	0.08
[49,60]	-0.99	0.42	-0.08	0.18	-0.29**	-0.20
[13,60]	-0.56	0.45	0.02	0.12	-0.13	-0.10

Figure 1: OTC Sample Characteristics as a Percentage of Listed Sample Characteristics

For each month, we plot the average size, average trading volume, and number of stocks in the OTC sample as a percentage of the corresponding statistics in the eligible listed sample. To minimize the influence of outliers and possible data errors, we transform the size and volume data for this comparison. In each month, we compute the difference in the cross-sectional average of the logarithms of size and ($1 plus) volume in the two samples. Then we invert the log transform to obtain a ratio that can be interpreted as the OTC characteristic divided by the listed characteristic. We exclude volume data from firms with zero monthly volume prior to July 1995, which is the date when volume data become reliable. The eligible listed sample consists of the CRSP stocks satisfying the same data requirements as the OTC sample described in Section I.B.

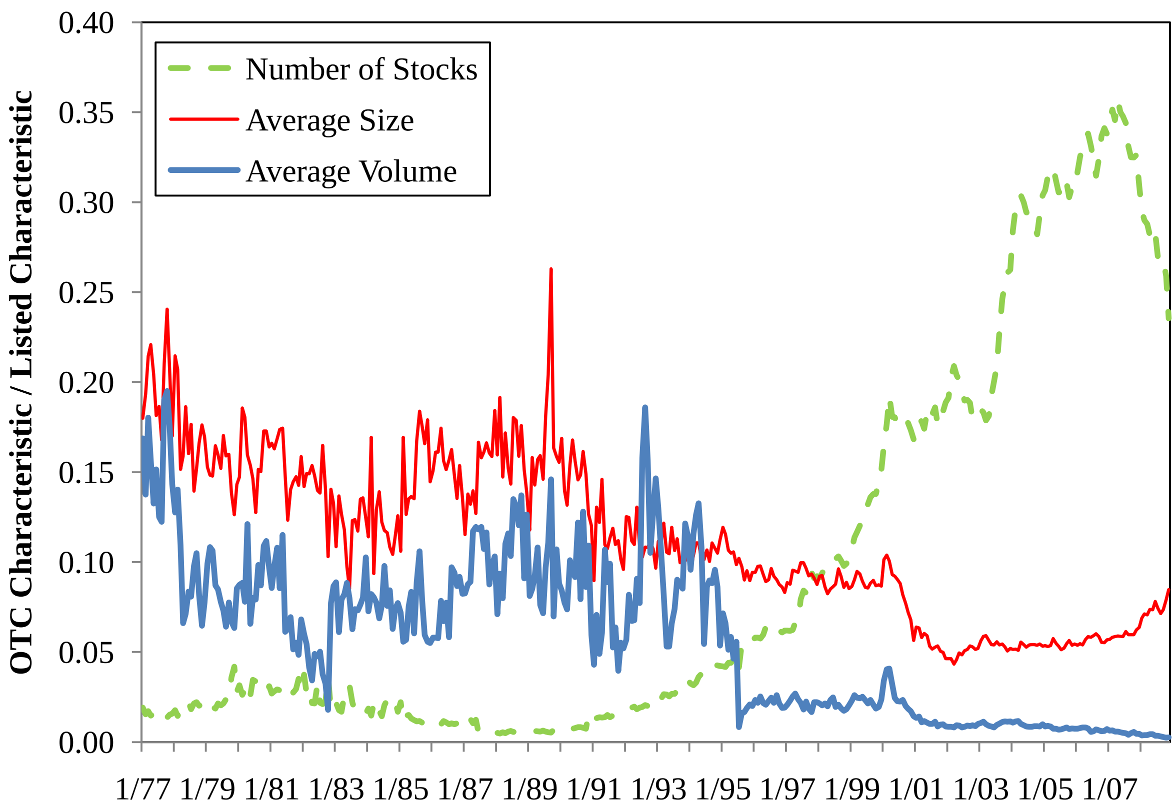

Figure 2: The Value of $1 Invested in Illiquidity Factors

We graph the cumulative returns for illiquidity factors in the OTC, comparable listed, and eligible listed samples. We use a logarithmic scale to represent the evolution of the value of a $1 investment from December 1976 to December 2008 for the illiquidity factors from each market. In all three markets, we sort stocks into quintiles according to their monthly *PNT* values, where *PNT* is the fraction of non-trading days in a month. Each *PNT* factor return is the difference between the gross-return-weighted returns of firms in the top and bottom *PNT* quintiles. We also plot the cumulative return of the value-weighted Pastor-Stambaugh illiquidity factor from the eligible listed sample. We assume that an investor begins with $1 long and $1 short and faces no margin or other funding requirements. To facilitate comparison, we scale the long-short portfolio positions in the OTC and eligible listed factors so that the volatility of these portfolios is equal to the volatility of the long-short portfolio based on the comparable listed factor. The comparable listed sample consists of stocks that are comparable to stocks in the OTC sample in terms of size, as described in Section I.C. The eligible listed sample consists of all listed stocks that satisfy the same data requirements as the OTC sample described in Section I.B.