Asset Pricing in the Dark:

The Cross Section of OTC Stocks

May 2011

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

Columbia University

Abstract

Over one thousand stocks trade in over-the-counter (OTC) markets. Unlike the listed NYSE, Nasdaq, and AMEX markets, OTC stock markets are opaque, with little or no disclosure and news dissemination, illiquid, and dominated by retail investors. These differences in information environment, market structure, and clientele could cause differences in the expected returns of OTC stocks and listed stocks. Indeed, we find that the return premium for illiquid stocks is much higher in OTC markets than in listed markets; and it is highest in OTC stocks with the lowest disclosure. The return premiums for small stocks and value stocks in listed markets also appear in OTC markets, but the premiums for return momentum and idiosyncratic volatility are small in OTC markets. These findings shed light on theories of the origins of these return premiums.

[*] The authors thank Bill Aronin for making available MarketQA data. We appreciate helpful comments from Randy Cohen, Kent Daniel, Larry Harris, Cam Harvey, Narasimhan Jegadeesh, Charles Jones, and seminar participants at Arizona and Columbia. Please send correspondence to paul.tetlock@columbia.edu.

We analyze the cross section of stock returns and liquidity of stocks traded in over-the-counter (OTC) markets. While hundreds of studies have investigated expected return patterns in listed stocks that trade on the NYSE, Nasdaq, and AMEX, there are a substantial number of US stocks—roughly one-fifth of the number of stocks listed on the three major exchanges—that trade in OTC markets. An OTC stock is one that trades on either the over-the-counter bulletin board (OTCBB) or pink sheet (PS) market, where at least one licensed broker-dealer agrees to make a market in the stock. We examine a large sample of OTC market data. To our knowledge, it is the largest cross section and the longest time series of US stock prices to become available since the Center for Research on Security Prices (CRSP) added data on Nasdaq stocks in 1984.

The OTC and listed stock markets are similar in several ways. Many firms in OTC markets 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. There are also many investors, including hedge funds, broker-dealers, and retail investors, who actively trade both groups of stocks.

There are three important differences between OTC and listed stocks. First, there is far lower liquidity in OTC markets than on the three major US exchanges. Using OTC stocks, we can construct illiquidity return factors from assets that are actually illiquid compared to the previous studies that focus on building illiquidity factors from stocks listed on the most liquid equity markets in the world.

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.[1] But, some OTC firms voluntarily disclose more information than is required. We

[1] 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). Before

exploit this to see if disclosure policy predicts returns and explore how disclosure and illiquidity are related to each other.

Third, the investor clientele of OTC and listed markets differ somewhat. Both OTC stocks and small listed stocks are primarily held by retail investors.[2] While small listed stocks are also held by many institutional investors, such as small mutual funds and hedge funds, these types of institutions often hold negligible amounts of OTC stocks. In fact, many pension and mutual funds are prohibited from investing in OTC stocks. The differences in liquidity, disclosure, and clientele across markets can shed light on the origins of well-known cross-sectional return premiums.

We devote special attention to measuring illiquidity premiums for OTC and listed firms. In theory and practice, markets with low transparency, such as the OTC market, tend to be highly illiquid—*e.g.*, see Glosten and Milgrom (1985) and Hendershott and Jones (2005). Illiquid stocks have higher expected returns in many theories—*e.g.*, see Amihud and Mendelson (1986), Diamond and Verrecchia (1991), Huang (2003), and Acharya and Pedersen (2005).[3] Several of these theories suggest that the price of liquidity may differ according to market liquidity and by implication market transparency.

We find that the return premium for illiquid stocks is much higher in OTC markets than in listed markets, whether we measure liquidity using the fraction of days with no trading, bid-ask spread, Amihud's (2002) illiquidity ratio, or simply trading volume. Because some OTC stocks are extremely illiquid, we use the probability that a stock does not trade (*PNT*) as a key

---

2000, the main disclosure requirement for OTC firms comes from Section 12(g) of the Exchange Act, which applies to firms with more than $10 million in assets and 500 shareholders of record. In practice, most OTC firms' shares are held through street name, allowing even some large OTC firms to circumvent this requirement.

[2] This similarity is an important reason why we focus on comparisons between OTC stocks and small listed stocks.

[3] Silber (1991) and Amihud, Mendelson, and Lauterbach (1997) provide direct evidence that illiquid stocks are priced at a discount.

measure of liquidity. In all comparisons of OTC and listed return premiums, we control for firm size by constructing a "comparable" sample consisting of listed firms with market capitalizations similar to the typical OTC stock. Sorting OTC and comparable listed stocks into *PNT* quintiles, we find that an OTC illiquidity factor returns 21.5% per year, whereas the comparable listed illiquidity factor returns just 1.7% per year.[4] Furthermore, the illiquidity return premium is highest in OTC stocks that do not publicly disclose book equity. Thus, a negative relationship between illiquidity premiums and transparency applies across listed and OTC markets and within the OTC market.

Next, we examine whether firm disclosure per se predicts returns. Controlling for differences in liquidity, we find that OTC firms that publicly disclose book equity have considerably higher stock returns than OTC firms that do not disclose book equity. Although this result seems inconsistent with traditional theories of disclosure, it could be related to the empirical accrual anomaly identified in Sloan (1996) and reviewed in Dechow, Khimich, and Sloan (2011). These authors argue that the accrual anomaly arises from investors' failure to understand that firms provide accounting information that portrays themselves as favorably as possible. Similarly, if investors fail to appreciate adverse selection in firms' disclosure policies, they may overprice OTC firms that choose not to disclose accounting information.

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"), low idiosyncratic volatility ("volatility"), and high past returns ("momentum") generalize to the less transparent

[4] To compare return premiums across markets, we scale the long and short positions in OTC portfolio to match the volatility of the listed factor. The annual Sharpe ratio of the OTC *PNT* factor at 1.16 is an order of magnitude higher than the Sharpe ratio of the listed *PNT* factor at 0.09. The average returns and Sharpe ratio of the listed Pastor-Stambaugh (2003) illiquidity factor—6.0% per year and 0.51, respectively—are more comparable to the corresponding OTC illiquidity factor returns but are still significantly lower than OTC illiquidity premiums. Our results are similar using a liquidity factor based on the effective trading cost measure in Hasbrouck (2009). The average returns and Sharpe ratio of this factor are 8.1% per year and 0.52 in the comparable listed sample.

OTC markets. Interestingly, the return premiums for size and value are similarly large in OTC markets and comparable listed markets. By contrast, the return premiums for momentum and volatility are much smaller in OTC markets than in listed markets. Under the interpretation that OTC and listed markets mainly differ in their transparency, these comparisons of return premiums can help us evaluate theories of expected returns whose predictions depend on investors' information environments, such as Hong and Stein (1999).[5] The estimated momentum premium of close to zero in OTC markets is especially interesting and indicates that momentum may not be a pervasive effect.

We find that multifactor models augmented with additional listed and OTC return factors cannot explain the large illiquidity, size, and value return premiums in OTC markets. To explore this further, we test whether OTC return factors co-move with their listed counterparts by computing contemporaneous and lagged correlations between these systematic return factors. The correlations are modest across the two markets, suggesting they are partially segmented.

We organize the rest of this paper as follows. Section I conducts a brief review of related literature. Section II provides additional institutional background on OTC markets and describes our data on OTC firms. Section III defines the key variables, such as illiquidity and disclosure, used in the statistical analyses. Section IV presents our main cross-sectional regressions in which we compare return patterns in OTC markets to those in listed markets. Section V presents time-series analyses of the returns on long-short portfolios formed on characteristics of OTC firms, such as size and liquidity. In Appendices A and B, we show how illiquidity affects our

[5] Differences in return premiums for momentum and volatility across OTC and listed markets could be related to differences in disclosure across the two markets. Information disclosure could affect the rate at which information diffuses across investors, which determines return momentum in Hong and Stein's (1999) theory. Information disclosure could also affect stock pricing in Miller's (1977) theory in which differences of investor opinion along with constraints on short sales negatively predict stock returns. For example, if disclosure jointly affects differences in opinion and idiosyncratic volatility, it may affect the volatility premium, too.

measurement of stocks' factor loadings and average returns. Section VI quantifies the degree of OTC and listed market segmentation. We discuss our results and conclude in Section VII.

I. Related Literature

A large number of studies, including Amihud and Mendelson (1986), Pastor and Stambaugh (2003), and Hasbrouck (2009) show that the least liquid listed stocks have qualitatively higher returns than the most liquid listed stocks. All these studies focus on liquidity effects in markets that are, in general, quite liquid. We are able to examine illiquidity return premiums in a market with homogeneous assets that is naturally illiquid, even though transaction prices are available to all investors. Examining illiquidity premiums in other illiquid markets such as real estate, private equity, and venture capital is more difficult because of heterogeneous assets, large search costs, and prices with little or no post-trade transparency.

Bekaert, Harvey, and Lundblad (2007) study emerging markets in an effort to measure illiquidity premiums in illiquid asset markets. Using a model that assumes market segmentation, they find that local liquidity risk has a significantly positive return premium of 27 basis points (bps) per month or 3.2% per year. Although analyses of emerging markets are informative and interesting in their own right, there are several advantages to using data on OTC stocks. First, there is no geographical, currency, or exogenously imposed investor segmentation in US OTC markets; we select common stocks incorporated in the US for both our OTC and listed equity samples. Furthermore, while companies can choose whether or not to list on the NYSE, Nasdaq, or Amex exchanges, companies typically cannot prevent their shares from being traded on OTC venues. Second, our time series is three times longer than the 11-year sample in Bekaert, Harvey, and Lundblad (2007), allowing for more precise inferences. Third, we do not rely on indirect measures of liquidity such as the proportion of days with zero returns, introduced by Lesmond, Ogden, and Trzcinka (1999), because we have data on daily volume for most of our sample.

There are relatively few studies analyzing stock pricing in OTC markets and even fewer investigating the degree of segmentation between OTC and listed markets. Previous research on OTC markets can be grouped into two categories: those studying aspects of market quality and those analyzing market manipulation. One example of the former is Bollen and Christie (2009), who document interesting features of OTC stock microstructure such as transactions and quotes patterns of firms traded on the PS in 2004 and 2005. Two other recent studies on OTC stock liquidity 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. Both studies either examine fewer than 100 firms or only a few years of data. In contrast, we analyze cross-sectional return predictability for 6,909 OTC firms from 1977 to 2008.

A recent study by Leuz, Triantis, and Wang (2008) investigates a firm's decision to "go dark," which means ceasing SEC reporting 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. Most firms going dark issue press releases stating that their motivation is to reduce compliance costs from disclosure requirements in general and the Sarbanes-Oxley Act in particular. Relative to firms continuing to report to the SEC, firms going dark are smaller and 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' required returns.

Because firms in OTC markets are subject to fewer disclosure requirements, their stock prices may be more susceptible to manipulation. Indeed, Böhme and Holz (2006) and Frieder and Zittrain (2007) show that many OTC stocks are involved in pump and dump schemes. Aggarwal and Wu (2006) find that OTC stocks account for 78 of 142 cases of stock market manipulation pursued by the US Securities and Exchange Commission (SEC) between 1989 and 2001. Based on this evidence, many investors view OTC markets as the "wild west" of securities markets (Bollen and Christie, 2009). This poor disclosure environment makes it especially interesting to test which return predictability patterns generalize from listed to OTC markets.[6]

The study most similar to ours is the contemporaneous and complementary 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, our focus is on the cross section of OTC returns, which Eraker and Ready do not examine. Our goal is to determine whether return patterns differ across OTC markets and listed markets and evaluate whether market transparency plays a role in these differences.

II. OTC Market Data

A. Institutional Details

Our data consist of United States common stocks traded in the OTCBB and PS markets from 1975 through 2008. We obtain this data through MarketQA, which is a data analytics

[6] We use minimum size and volume filters to minimize the probability that pump and dump schemes affect stocks in our sample.

platform from Thomson-Reuters. The OTCBB and PS 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 OTCBB and PS 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. Other FINRA rules guarantee best execution of customer orders, guard against front-running of customer orders, ensure accurate and timely trade reporting, and require disclosure of short interest positions.

Prior to 2000, the main 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 $10 million in assets and more than 500 shareholders of record, not beneficial owners. Because nearly all owners of OTC firms' shares hold their shares through "street names," such as their broker's name, 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 listed 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). The disclosure requirements for PS firms are not as strict. After August 2007, the firm displaying quotations—Pink OTC Markets Inc.—began providing incentives for traded firms to provide timely financial information to the Pink Sheets News

Service. A byproduct of the minimal formal requirements is that firms traded on the OTCBB and Pink Sheets are very heterogeneous. Some are large, liquid, and transparent firms, while others are small, thinly traded, and so-called "dark" firms that have not provided any financial information to the Pink Sheets News Service in the past six months.

The majority of investors in the firms traded exclusively on OTC markets are individuals and lightly regulated institutions, such as hedge funds, because SEC rules prevent many institutions from holding unlisted stocks. The disclosures at the web site for Pink OTC Markets Inc. (www.otcmarkets.com) offer insights into the probable investor clientele in OTC stocks:

> "The OTC market presents investment opportunities for intelligent, informed investors, but also has a high degree of risk. ... Unsophisticated or passive investors should completely avoid the OTC markets."

Most full service and discount brokerages allow individual investors to trade in OTCBB and PS stocks, including Ameritrade, E-Trade, Fidelity, and Scottrade.

B. OTCBB and PS Data

For all common stocks traded in the OTCBB and PS from 1975 through 2008, we obtain daily trading volume, market capitalization, and closing, bid, and ask prices from MarketQA. Our analysis uses only OTCBB and PS firms that have no stocks that are concurrently listed on the NYSE, Nasdaq, or AMEX exchange. This restriction eliminates many Nasdaq firms with joint listings on the OTCBB. We purposely exclude listed firms to ensure that we are analyzing a set of firms that is as orthogonal as possible from those listed on the traditional venues. To ensure adequate data quality, we further restrict the sample to firms meeting the following requirements at any time in the previous month:

- Non-missing data on price, market capitalization, and returns

- Market capitalization exceeds $1 million in 2008 dollars
- Price exceeds $1
- At least one non-zero daily return
- Positive trading volume, after 1995 when volume data are reliable

Our final OTC sample includes an average of 487 firms per month.

C. Comparison to CRSP

We gauge the size and importance of the OTC stocks in our sample by comparing them to CRSP ("listed") common stocks. We define three groups to make these comparisons: active, eligible, and comparable stocks. *Active* stocks have at least one non-zero daily return in the past year. *Eligible* stocks meet the same data requirements listed 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. That is, these listed firms are comparable to OTC firms in terms of size.

Table 1 provides a snapshot of the summary statistics for the OTC, comparable listed, and eligible listed samples in March of 2000—the peak of OTC trading activity in absolute terms. For this month, the median market capitalization of an OTC stock is $21.2 million, as compared to $169 million for the eligible listed sample.[7] The difference in total market capitalization is much larger ($91.3 billion versus $16.7 trillion) because the largest firms in the eligible listed sample are enormous and because there are five times fewer OTC stocks (1250 OTC stocks versus 6524 listed stocks). The annualized median OTC trading volume is only 3.6%

[7] Table 1 uses rounding to three digits. Listed trading volume statistics do not adjust for possible double-counting of Nasdaq interdealer trades.

of the median eligible listed trading volume ($9.9 million versus $272 million, respectively). The aggregate annualized transactions in OTC stocks exceed $141 billion, whereas trades in eligible listed stocks exceed $42 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. By construction, the median size is identical in the two samples. In March 2000, the mean size and volume in the OTC markets are more than twice as large as the amounts in the comparable listed sample, but this relation changes over time. In fact, median trading volume is actually slightly higher for the comparable listed sample. The number of stocks in the OTC and comparable listed samples are similar at 1240 and 1700, respectively.

Averaging across all months in our sample, the number of firms is 5,229 in the listed sample and is 5,708 in the active listed universe. The averages are 487 in our OTC sample and 3,357 in the active OTC universe. The OTC sample contains far fewer firms than the active OTC universe primarily because most OTC firms have a stock concurrently listed on the Nasdaq, making them ineligible for the sample. The other sample restrictions, however, are not onerous in the sense that the listed sample contains 92% of the active firms in CRSP. In an average month, the number of firms in the OTC sample is 9.6% of the number in the listed sample.

The average firm size and trading volume in the OTC sample are also an order of magnitude smaller than they are in the listed sample. The median market capitalization in the OTC sample is on average 14.3% of the median in the listed sample. The median dollar volume in the OTC sample is on average 3.3% of the median in the listed sample. Because many OTC firms' volume statistics are unreliable before 1995, we use the ratio of means before 1995 instead of the ratio of medians.

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 active listed sample. It demonstrates that the relative size of firms in the OTC markets has always been higher than the relative trading volume—except for October 1977, when there is an unusual spike in OTC volume. This gap between relative size and volume widens sharply after the Internet boom. Relative size and volume both peaked in the late 1980s, whereas the number of firms in the OTC sample has grown rapidly since that time. The transparency and disclosure reforms in the OTC markets after 2000 partly explain the increase in OTC firms in the past decade.

[Insert Figure 1 here.]

Figure 2 compares the distributions of firm size in the OTC and listed samples. The bottom blue, solid line shows the size percentile in the listed sample that corresponds to the median size in the OTC sample. The median OTC firm usually corresponds to the bottom size decile in the listed sample. The other lines represent the size percentiles in the listed sample corresponding to the 75th, 90th, and 99th percentiles of size in the OTC sample. The firm at the 90th percentile of OTC size is often bigger than the median listed firm. The firm at the 99th percentile of OTC size is usually as big as the firm at the 80th percentile of listed size. That is, although the typical OTC firm is much smaller than its listed counterpart, there are a significant number of large OTC firms and these large OTC firms have market capitalizations similar to large listed firms.

[Insert Figure 2 here.]

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 well in the billions. The largest OTC firms typically come from the banking, retail, manufacturing, health care, and technology industries. 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. Some companies trade on PS after delisting from NYSE, Amex, or Nasdaq, a phenomenon that Harris, Panchapagesan, and Werner (2008) and Macey, O'Hara, and Pompilio (2008) study in detail. For example, Delphi Corporation filed for Chapter 11 bankruptcy in 2005 and traded on the PS while being reorganized. Its largest market capitalization is $13 billion in February 2008. Delphi stock ceased trading on PS after it became a private firm in October 2009.

[Insert Table 2 here.]

In summary, OTC firms are, on average, much smaller and trade far less often than listed stocks. However, because there is considerable heterogeneity in the OTC sample, about 10% of OTC stocks are bigger than the median-size listed stock. The number of OTC firms is not negligible; in an average month, the number of OTC firms is approximately 10% of all listed stocks across our sample. This percentage increases 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 past returns, idiosyncratic volatility, liquidity, and disclosure.

We compute a stock's return as the monthly percentage change in Market QA's "total return index" variable, which is a cumulative stock price that accounts for dividends and splits.[8]

[8] MarketQA conducts extensive error checks and cleans raw data before constructing the total return index variable.

We assign a monthly index value based on the last available daily index value. Because some OTC stocks are not traded frequently, the most recently available daily index value may be several months old. Our tests use two past returns 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 momentum.

To estimate a stock's beta in month t on multiple 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 where 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 liquidity factor (LIQ) 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 non-synchronous trading by extending the method in Lo and MacKinlay (1990). Appendix A describes this procedure.

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 the stock's daily returns on the daily MKT, SMB and HML factors from month $t - 2$ to month $t - 1$. The stock's idiosyncratic volatility (*Volatility*) in month t is the log of the standard deviation of the residuals from its time series regression.

We use four measures of individual stock liquidity in our analyses. The variable *PNT* denotes the fraction of days with zero trading volume in each month.[9] The variable *Volume* is the log of one plus a stock's monthly dollar volume. Our third measure, *Amihud*, is the log of the monthly average of the absolute value of daily returns divided by daily dollar volume (Amihud, 2002). The variable *Spread* is the difference between a stock's ask quote and bid quote divided by the bid-ask midpoint from the last day when both quotes are available. The *Spread* and *Amihud* measures capture the price impact of trading different quantities of shares, whereas *PNT* and *Volume* reflect the ability to trade a stock at all.

Our return predictability tests use data on firm disclosure, 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 or Reuters Fundamentals. Firm *Size* is the log of shares outstanding times the most recently available closing price, 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 return of OTC stocks is negative at -0.25% per month compared to 0.69% per month for comparable listed stocks. Eraker and Ready (2010) investigate this negative average return for OTC stocks in detail. The cross-section of OTC returns is also significantly more disperse than listed stocks, with cross-sectional standard deviations of 27.8% and 19.3%, respectively. OTC stocks are somewhat more volatile than comparable listed stocks, with average monthly average volatilities of 6.83% and

[9] Our main results on the illiquidity premium become slightly stronger if we redefine *PNT* as the fraction of days in which trading volume is at least 100 shares.

4.25% for the OTC and listed samples, respectively. By construction, the size of the OTC and comparable listed samples are similar as the comparable sample consists of the smallest listed stocks. This also results in both the OTC and comparable listed stocks having similar distributions of book-to-market ratios.

However, the OTC and listed samples exhibit very different levels of disclosure and liquidity. The mean of the *Disclose* dummy for book equity data is 0.52 in the OTC sample and 0.82 in the comparable listed sample, suggesting that 48% of OTC firms choose not to disclose accounting data whereas only 18% of listed firms omit this information.[10] The average of log volume (*Volume*) is much smaller for OTC stocks (8.59) than for listed stocks (10.84). OTC stocks also trade much less frequently: the mean fraction of days with no trading in a month, *PNT*, is 0.53 for OTC stocks compared to 0.19 for listed stocks. The 95th percentile *PNT* value is 0.94, implying that the least frequently traded OTC stocks trade on just one day per month. Average OTC *Spreads* are quite high at 0.13 versus 0.07 for comparable listed stocks.

Motivated by these high bid-ask spreads, we explicitly estimate the impact of the Blume and Stambaugh (1983) bias in stocks' average returns arising from bid-ask bounce in Appendix B. We find that the bid-ask bounce bias has little impact on our estimates of cross-sectional return premiums in both the regression and portfolio estimates. Because the bias is small, we present the main results below using the standard methodology to simplify the exposition.

IV. Cross-Sectional Regressions

In Table 4, we investigate the cross-sectional premiums of factor loadings and firm characteristics. Each cell reports the Fama and MacBeth (1973) coefficients, along with standard

[10] We are currently analyzing whether this statistic may also reflect incomplete coverage in CompuStat and Reuters.

errors in parentheses. The point estimate is the weighted-average of monthly coefficients, where each coefficient weight is the inverse of the squared monthly standard error as in Ferson and Harvey (1999). We compute standard errors for the time series of the monthly coefficients using the estimator in Newey and West (1987) with the number of lags equal to the recommendation in Newey and West (1994). We group the regressors into firms' factor loadings, including betas on MKT, SMB, HML, and UMD, and firms' characteristics, including size, volatility, past returns, liquidity characteristics, and disclosure policy.[11] Thus, we focus on the cross-sectional predictors of returns commonly used in the extensive literature on listed stocks. Panel A reports the coefficients for OTC stocks, Panel B reports the coefficients for comparable listed stocks (similar in size to OTC firms), and Panel C reports the coefficients for the eligible listed sample (all listed firms meeting our sample restrictions).

[Insert Table 4 here.]

A. Cross-Sectional R^2s

The first striking point in Table 4 is that there is far more cross-sectional predictability in OTC stocks than in listed stocks. In nearly all regressions (I to VI), the average R^2 is significantly higher in the regressions using OTC stocks (Panel A) than the corresponding regressions using listed stocks (Panels B and C). For example, in Regression VI containing all factor loadings and coefficients, the average R^2 is 28.4% in the OTC sample compared to just 5.0% and 5.8% in the comparable and eligible listed samples, respectively. This is despite the higher volatility, on average, for OTC stocks (4.25% for comparable listed stocks versus 6.83% for OTC stocks).

[11] Although using estimated betas in these predictive regressions induces an attenuation bias in the beta coefficients, this bias cannot explain negative point estimates for these coefficients.

B. Factor Loadings

The cross-sectional regressions in Table 4 show that many of the same cross-sectional effects long documented in listed stocks are also manifest in OTC stocks. Regression I employs only factor betas. The market beta is significantly negatively priced in OTC stocks, which Fama and French (1992) and Jagannathan and Wang (1996) find in the listed universe, too. In the OTC sample, the factor premiums for HML and UMD betas are positive, but the premium for SMB betas is negative and significant at the 1% level. Interestingly, when these factor loadings are used jointly with all predictive variables in Regression VI, the factor premiums all shrink in magnitude and only the coefficient on market beta remains marginally significant at the 5% level. This is similar to the findings of Daniel and Titman (1997), who show that characteristics often have greater ability to predict the cross section of stock returns than factor loadings.

The OTC factor premiums in Regression I are similar to those found in the literature for listed stocks and to the results for the listed samples shown in Panels B and C. Specifically, the MKT and SMB beta premiums are negative, while the HML and UMD beta premiums are positive in the listed samples. In the listed sample with firms comparable in size to OTC firms (Panel B), all factor premiums are insignificant in the joint Regression VI specification. In the entire eligible listed sample (Panel C), the SMB and HML factor premiums are significantly negative and positive, respectively. This implies that these return premiums are strongest amongst the largest listed stocks.

C. Size, Past Returns, Book-to-Market, and Volatility

In Regression II, we augment the factor loadings with size and past return characteristics. In the OTC market, size has a coefficient of -0.516, which is significant at the 1% level. This is similar to the -0.479 coefficient for the comparable listed sample in Panel B, but the size effect is non-existent in the eligible listed sample in Panel C.

In contrast, the past return effects are much weaker in the OTC sample than in listed stocks. In Regression II, the coefficient on past one-month and 12-month returns are -0.017 and 0.000 in OTC stocks, respectively, as compared to -0.057 and 0.016 in comparable listed stocks (Panel B) and -0.042 and 0.010 in eligible listed stocks (Panel C). The coefficients on past returns in the OTC sample are thus an order of magnitude smaller than the listed samples. OTC stocks exhibit no evidence of return momentum.

Regression III reexamines the characteristic effects by including only the HML beta and adding the log of book-to-market equity (*B/M*) and the monthly volatility of daily returns. Because we mainly have book equity data since 1993, this regression only includes data from 1993 to 2008.[12] The coefficient on book-to-market equity is positive and highly significant in all three panels, implying that the value effect is pervasive across the OTC and listed samples. In all three panels, including the book-to-market characteristic variables reduces the coefficient on the HML beta to a value that is insignificantly different from zero. Regression III shows similar coefficients on size and past returns as Regression II, with the size effect becoming even larger.

The coefficients on volatility in Regression III are large, negative, and statistically significant in Panels A, B, and C: -0.204, -0.318, and -0.381, respectively. The results in the listed sample are consistent with the results in Ang et al. (2006), which shows that stocks with

[12] This specification also includes a 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.

high volatility have low returns in the cross section. We reexamine the OTC volatility effect using the returns on calendar time portfolios in the next section.

D. Liquidity

Regression IV considers three liquidity variables: volume, the Amihud (2002) measure, and the frequency of non-trading, *PNT*. In the OTC sample, all three measures are significantly priced and they explain slightly more cross-sectional variation than the four factor loadings in Regression I (R^2s of 7.0% versus 6.2%). The signs of these liquidity measures are notable. The coefficient of -0.606 on volume is economically reasonable: investors may require higher returns for holding stocks that are less liquid, as measured by lower volume. However, the negative volume coefficient is opposite to the finding in Gervais, Kaniel and Mingelgrin (2001) that stocks with higher (normalized) volume tend to have higher average returns. The coefficient on the Amihud measure of -0.627 is also the opposite to Amihud's (2002) and others' findings. Interestingly, the two Amihud coefficients in Regression IV in Panels B and C in the two listed stock samples are also significantly negative (-0.193 and -0.395, respectively). The joint regressions discussed below shed more light on this unexpected result.

In Regression IV, the coefficients on *PNT*, which measures the extent of non-trading, are significantly positive in the OTC sample (Panel A), the comparable listed sample (Panel B), and the eligible listed sample (Panel C), with coefficients of 5.054, 2.213, and 2.478, respectively. When we control for characteristics in Regression V and both factor loadings and characteristics in Regression VI in the OTC sample, the *PNT* coefficient is the only liquidity coefficient to maintain its sign and statistical significance. The other two liquidity variables become insignificant at even the 10% level. The size, volatility, and momentum coefficients retain their signs and statistical significance across Regressions II, III, and V in Panels A and B. This remark generally applies to the eligible listed sample in Panel C.

E. Joint Effects and the Impact of Disclosure

Regression VII in Table 4 includes all factor loadings and firm characteristics, including the direct impact of the *Disclose* dummy and its interaction with illiquidity, as measured by *PNT*. The coefficient on the *Disclose* dummy is economically large at 1.734% per month and highly statistically significant. The interpretation is that, holding other firm characteristics constant, firms that disclose book equity data have higher returns. The coefficient on the interaction between illiquidity and disclosure (*PNT**Disclose*) is also significant at -2.036. This implies that the illiquidity premium—*i.e.*, the coefficient on *PNT*—declines from 7.689 to 5.653 for firms that disclose book equity.

Overall, the strongest cross-sectional predictors of OTC stock returns are size, volatility, *PNT*, and *Disclose*, which are all significant at the 1% level, with coefficients of -0.955, -0.192, 7.689, and 1.734, respectively. The *PNT* liquidity measure is the only liquidity variable that has a significant return premium. By comparison, for the comparable listed markets in Panel B, all liquidity variables are statistically significant. In this specification, the volume coefficient has the same positive sign that Gervais, Kaniel, and Mingelgrin (2001) find.

For OTC stocks, the one-month return reversal (*Ret*[-1]) coefficient of -0.018 is significant at the 5% level, but the 12-month return momentum (*Ret*[-12,-2]) coefficient of 0.002 is insignificant. The one-month reversal coefficients of -0.058 and -0.041 and 12-month momentum coefficients of 0.016 and 0.010 are much larger in the listed samples in Panels B and

C, respectively. Thus, return reversals seems to exist in OTC markets, but momentum in OTC stocks is much weaker than in listed stocks.

V. OTC Portfolio Returns

We construct calendar-time portfolios of OTC stocks ranked on various characteristics to estimate the expected returns of OTC factors, much like the large listed stock literature. These portfolio tests complement the multivariate regression results in the previous section in two ways. First, we can estimate the economic magnitude of factor premiums without imposing linearity as in a regression. Second, we can control for listed factor returns in estimating the OTC factor premiums to assess whether premiums are related across markets. Our analysis focuses on the size, value, and liquidity portfolios because these characteristics exhibit the highest return premiums in OTC markets. We also estimate portfolio returns for return momentum, idiosyncratic volatility, and four liquidity measures: *PNT*, *Volume*, *Spread*, and *Amihud*.

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 equal-weighted returns in month t of firms in the top and bottom quintiles, as ranked by their characteristics in month $t – 1$ within the set of firms in our OTC sample in month $t – 1$. A portfolio's excess return is its monthly return minus the monthly risk-free rate prevailing at the end of the prior month. A portfolio's alpha is the intercept from a time-series regression of monthly excess portfolio returns on various monthly factor returns.

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 following Dimson (1979). We analyze five factors based on listed returns, including the MKT, SMB, HML, UMD, and LIQ factors. We create a sixth factor equal to the value-weighted OTC market return minus the 30-day Treasury Bill rate. Our three benchmarks are the OTC CAPM, Listed CAPM, and the Listed Five-Factor models. The OTC and Listed CAPM models include only the OTC market and listed market factors, respectively. The Listed Five-Factor model comprises the MKT, SMB, HML, UMD, and LIQ factors.

We summarize the return premiums for each OTC return factor in Panel A in Table 5 and the factor loadings in Panel B. Panel A displays the average monthly returns and alphas of each OTC return factor relative to the three factor model benchmarks. This panel also shows the annualized Sharpe Ratio of the raw OTC factors alongside the Sharpe Ratios of the raw return factors from the comparable listed sample. Panel B in Table 5 reports the factor loadings on each factor, where the OTC and listed market factor loadings come from the CAPM models. Panel B also reports the R^2 from each of the three factor models.

[Insert Table 5 here.]

Table 5 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 and value premiums are similar in OTC and listed markets; and (3) the momentum and volatility premiums are much smaller in OTC markets.

A. Liquidity Premiums

The first four rows of Table 5, Panel A illustrate the first finding. The Sharpe Ratios of the OTC illiquidity factors based on *PNT*, *Volume*, and *Spread* are all very large: 1.17, -1.31, and 1.63, respectively. The Sharpe Ratio of 0.64 for the Amihud factor is qualitatively consistent, but only half as large. The large Sharpe ratio for the *PNT* factor is consistent with the large coefficient on the *PNT* characteristic in the multivariate regression shown in Table 4.

The first four columns of Panel A show that the average monthly returns of the illiquidity factors are similar to the monthly alphas computed using each of the multifactor models. Specifically, none of the multifactor models (the OTC CAPM, Listed CAPM and Listed Five-Factor model) can explain even half of any of these four illiquidity premiums. In particular, the Pastor-Stambaugh illiquidity factor from listed markets cannot explain the high returns to illiquid OTC stocks. Panel B shows that none of the exposures of the OTC illiquidity factors to the listed illiquidity factor is positive and statistically significant. Thus, exposure to listed stock market liquidity factors cannot explain the high premiums for the OTC illiquidity factors.

B. Size and Value Premiums

The second notable finding in Table 5 is that the annualized Sharpe Ratios for the size and value factors are high in both the OTC and comparable listed markets: -1.39 and -0.98 for the two size factors and 1.31 and 1.18 for the two value factors. The magnitudes of the size and value OTC monthly return premiums of -3.72% and 3.20% are higher than the comparable listed premiums of -0.90% and 1.33%. The OTC size and value factors are more volatile, at 9.27% and 8.46% per month, than their listed factor counterparts, which have monthly volatilities of 3.21% and 3.90%. Clearly, the size and value premiums pervasively found in listed markets also exist in OTC equity markets.

Interestingly, the factor loadings in Panel B show that neither the listed size nor the listed value factor explains much of the variation in the OTC size and value factors. The alpha of the OTC size factor is -4.00% per month after controlling for its loading on the listed size factor and the other four listed factors. These listed factors explain just 10.8% of the variance in the OTC size factor. The alpha of the OTC value factor is 3.50% per month after controlling for its loading on the five listed factors, which explain just 36.0% of the variance in the OTC value factor. Thus, there are large, independent size and value effects in the OTC market that are not captured by listed size and value effects.

To compare the magnitude of the size premiums in the OTC and comparable listed markets, we scale down the long-short portfolio positions in the OTC size portfolio so that it has the same volatility as the comparable listed size factor. The size premium between size quintiles in the comparable listed sample is 10.8% per year, while the OTC size premium with the same volatility is 15.5% per year. The size premium in OTC markets is partly driven by the negative average returns (-10.9% per year) of the OTC firms in the top size quintile. In fact, the value-weighted OTC market return is -12.4% per year, whereas the equal-weighted OTC market return is -3.0% per year. This is consistent with the negative average returns for the aggregate OTC market reported in contemporaneous work by Eraker and Ready (2010).

C. Momentum and Idiosyncratic Volatility

The third key result is that the return premiums for momentum and volatility in OTC markets are surprisingly small. Whereas the Sharpe ratio of 1.25 for momentum is the largest among all listed factors in Table 5, Panel A, the Sharpe ratio of 0.24 for momentum in OTC markets is the smallest of all OTC factors considered and is also statistically insignificant. In contrast to some of the other factors, the OTC and listed momentum factors are significantly positively correlated. This explains why the alpha of the OTC momentum factor against the

Listed Five-Factor model—which includes listed momentum—is actually negative, but insignificant.

Panel A reports some evidence that highly volatile OTC stocks have lower average returns than less volatile stocks. However, this result is not robust to controlling for the OTC CAPM factor. That is, the highly negative average market return of OTC stocks seems to be closely related to the low average returns of highly volatile OTC stocks. Panel B shows that the OTC market beta of the long-short OTC volatility factor is 1.08 and that OTC market exposure explains 26.8% of the variance in the volatility factor. This is interesting also because the standard listed factor loadings and characteristics do not alter the negative cross-sectional coefficient on volatility for OTC stocks in Table 4; only the OTC market factor makes the volatility effect insignificant.

Our OTC evidence on the momentum and volatility effects differs from the results in evidence on momentum and volatility in listed stocks reported in studies by Jegadeesh and Titman (1993) and Ang et al. (2006), respectively. Both the OTC momentum and volatility premiums are directionally consistent with the comparable listed return premiums, but the magnitudes are much smaller. In particular, the listed momentum premium is several times larger than the OTC momentum premium and the OTC premium for volatility has an unexpected positive sign after controlling for the OTC market.

D. Portfolio Returns Over Time

In Figures 3A and 3B, we graph the cumulative returns for the illiquidity, size, and value factors in the OTC and comparable listed samples. Figure 3A 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 liquidity factors from the eligible listed sample: the factor based on *PNT* quintiles and the Pastor-Stambaugh liquidity factor. Figure 3B depicts the size and value factors in the OTC and comparable listed markets. Both figures 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.

[Insert Figures 3A and 3B here.]

Figure 3A shows that the OTC illiquidity factor based on *PNT* quintiles has extremely high cumulative returns. This factor performs relatively poorly in the first few years of data when the OTC volume data is likely to be of poorer quality. The only other time in which the illiquidity factor declines substantially is just prior to the March 2000 peak of the Nasdaq stock market. One possible reason is that the short side of this portfolio contains highly liquid technology stocks, which would also explain the rapid rebound of the illiquidity factor after March 2000.

The magnitude of the OTC *PNT* factor dwarfs the magnitude of all the liquidity factors based on the listed samples. Although the Pastor-Stambaugh factor is the most successful listed factor, a one-dollar investment in this factor produces “only” $11.73 by the end of the sample. By contrast, a dollar invested the OTC *PNT* factor yields over $502 at the end of the sample. Moreover, as Panel A in Table 5 shows, there are actually two OTC factors based on other liquidity measures—*Volume* and *Spread*—that provide even higher Sharpe ratios than the OTC *PNT* factor. In summary, liquidity premiums in OTC markets dwarf those in listed markets.

Figure 3B shows that both the size and value factors in the OTC and listed samples exhibit high cumulative returns, though not as high as the OTC illiquidity factor. For example, a $1 long-short investment in the OTC size factor grows to more than $114 across the 32-year sample. Although the returns on the OTC size factor are barely positive in the first decade of the sample, the returns during the second half of the sample are extremely high. The value factor also has lower returns in the first few years when book equity data become available. Again, the OTC data coverage or quality may be poor in these earlier years. Despite this limitation, we find robust evidence of illiquidity, size, and value premiums in the OTC markets.

VI. OTC and Listed Market Segmentation

Motivated by the discrepancies in the pricing patterns in OTC and listed markets, we investigate the degree of segmentation between the two markets. This section analyzes the time-series relations between systematic return and liquidity factors in OTC and listed markets. We first assess the contemporaneous correlations between returns and liquidity in both markets and then estimate vector auto-regressions (VARs) to examine predictive relationships.

A. OTC and Listed Return Factors

Before we examine aggregate market returns in OTC and listed markets, we briefly revisit the earlier evidence in Table 5 on the relationship between systematic return factors in OTC and listed markets. These results suggest that most of the systematic return variance in size, value, momentum, volatility, and liquidity factors in OTC markets is unrelated to activity in listed markets. The last column in Panel B in Table 5 shows that the listed market, size, value, momentum, and liquidity factors jointly explain between 10.8% and 39.8% of the variance in the four OTC liquidity factors.

Table 6 performs the same time-series regression as in Table 5, using the excess return on the value-weighted OTC market as the dependent variable. For each contemporaneous listed factor included as a regressor, we include six monthly lags of the listed factor to correct for non-synchronous trading following Dimson (1979). The key finding is that the listed CAPM explains only 28.8% of the variation in the OTC market, while the five-factor model explains 43.2%. Thus, most of the variance in OTC market returns remains unexplained by the five-factor model. 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, and volatility factors.

[Insert Table 6 here.]

We do not analyze the predictive relationships between OTC and listed return factors in depth because these tests are difficult to interpret in light of the non-synchronous trading issues that affect OTC portfolio returns and, to a lesser extent, listed portfolio returns. For example, a positive coefficient on the listed return factor in predicting next month's OTC factor returns is consistent with both non-synchronous trading and the slow diffusion of information from listed to OTC markets. Not surprisingly, we obtain several positive and significant coefficients on the first-order lags of listed factor returns in our specifications in Tables 5 and 6.

B. OTC and Listed Stock Liquidity

To assess the contemporaneous co-movement between aggregate liquidity in OTC and listed markets we compute correlations of aggregate liquidity in the OTC, comparable listed, and eligible listed markets, where we define liquidity as the equal-weighted average of *PNT* across stocks at each point in time. In each case, we compute an abnormal or detrended version of *PNT* (*APNT*) that is equal to *PNT* in the current month minus the average *PNT* value in the previous three months. This procedure removes the time trend effects in liquidity.[13] We define the value of *APNT X* months ago as LagX(*APNT*).

Figure 4 depicts the equal-weighted average of *PNT* for the OTC market and the two listed samples. The figure incorporates corrections for four possible structural breaks in the OTC and listed liquidity measures. The first break occurs in 1982 and corresponds to the month in which volume data on listed Nasdaq firms becomes available. The other three breaks occur in 1987, 1990, and 1995, and correspond to possible changes in market structure and volume data availability for OTC stocks.[14] We define five subperiods based on these four breakpoints. Under the assumption that the data from the last subperiod is the most reliable, the figure splices together each of the three average *PNT* measures from these five subperiods so that each liquidity measure is continuous at the four breakpoints.

[Insert Figure 4 here.]

The average value of *PNT* in the OTC market is similar to the average *PNT* value in the comparable listed market from 1977 through 1990, where both measures of non-trading are approximately 20%. From 1990 to 2008, however, non-trading in OTC markets increases to over 50%, while non-trading in comparable listed markets decreases to just 10%. Despite these differences in long-term trends, the two liquidity measures appear to be positively correlated at the monthly horizon. The average liquidity in the full eligible listed sample, which constitutes almost all listed traded stocks, is much higher than liquidity in both of the OTC and comparable

[13] The results are qualitatively similar for the raw version of *PNT*.

[14] The composition of our OTC sample changes when the number of firms suddenly decreases in 1987 and suddenly increases in 1990. More OTC volume data becomes available in 1995. These three structural changes have a significant impact on the fraction of firms with non-missing data that have zero trading volume.

listed samples; non-trading in eligible listed stocks gradually decreases from 15% in 1990 to 3% in 2008. Thus, while liquidity has generally improved for the large listed stocks and smaller listed stocks over the last 30 years, OTC liquidity has, on average, become worse, especially over the past 15 years.

[Insert Table 7 here.]

Table 7 reports the correlations between aggregate liquidity (*APNT*) in the OTC and listed markets for the full sample and for the five subperiods described above. The first row in Table 7 reports that the correlation between aggregate liquidity in OTC and comparable listed markets is 0.38 for the full sample. Even in the period from 1995 to 2008 when the correlation reaches 0.69, the aggregate listed liquidity measure explains less than half ($0.69^2 = 48\%$) of the variance in OTC liquidity. The correlations in column 2 of Table 7 between aggregate liquidity in the OTC and the eligible listed markets are, in most cases, slightly lower than the corresponding correlations between OTC and comparable listed liquidity. For example, the correlation for the full sample is just 0.24. One explanation for these low correlations is that OTC and listed markets are segmented. This is consistent with the different average return premiums across OTC and listed stocks and the fact that listed factor premiums cannot explain OTC factor premiums, as shown in Table 5.

[Insert Table 8 here.]

Finally, we scrutinize the predictive relationships between aggregate liquidity in the OTC and listed markets using a VAR with three monthly lags of the *APNT* measure in both markets. Panels A and B in Table 8 report the results from two VARs in which we separately compare OTC liquidity to liquidity in the comparable and eligible listed samples, respectively. The main result in both VARs is that there are no positive, and statistically significant at the 5% level, predictive relationships between liquidity in OTC markets and listed markets. That is, listed liquidity does not positively predict OTC liquidity and vice versa. In the regression predicting OTC liquidity ($APNT_{OTC}$) in Panel A, there is a marginally significant negative coefficient on the first lag of comparable listed liquidity. This could arise if investors trade more in OTC markets after periods of relative illiquidity in listed markets. The lack of a strong predictive relationship is consistent with the theory that OTC and listed markets are partially segmented.

VII. Concluding Discussion

While some cross-sectional return premiums in listed markets, such as size and value, generalize to OTC markets, other return premiums are strikingly different. The premium for illiquidity in OTC markets is an order of magnitude larger than in listed markets. The momentum and volatility effects that are pronounced in listed markets are economically small or non-existent in OTC markets. Listed return factors cannot explain the majority of the variation in OTC return factors. This suggests that the two markets are partially segmented and that OTC markets provide independent evidence on return patterns.

Some differences in return premiums across OTC and listed markets may be attributable to differences in transparency across the two markets. In particular, the relatively high illiquidity premium in OTC markets may be related to the scarcity of liquidity in the relatively opaque OTC market environment. Consistent with this interpretation, the illiquidity premium is highest for OTC firms that do not disclose their book equity.

In addition, the momentum effect in OTC markets may be weak or non-existent because the transmission of information about OTC stocks is very different from the transmission of news about listed stocks. Because OTC stocks have low or no information disclosure requirements, investors may view information about OTC stocks as less credible than information about listed stocks. Thus, OTC investors may not include a group of "newswatchers," in the sense of Hong and Stein (1999), who mainly pay attention to firms' fundamentals and disregard stock price movements. In the absence of gradual information diffusion across newswatchers, the model in Hong and Stein (1999) would not predict any momentum, which is what we observe for the OTC markets.

Another potential explanation for the weak momentum effect in OTC markets is the role of institutional investors. Studies of listed stocks show that 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). While institutional holdings of OTC stocks are very small, we cannot conclude that it is the low presence of institutions per se that leads to a low momentum premium in the OTC market. The clientele of small listed stocks—our comparable listed sample—is also predominantly retail, but the momentum effect is strong in this sample. The institutions actively trading small listed stocks, however, may have different characteristics from the institutions actively trading OTC stocks. In particular, institutions holding OTC stocks tend not to be mutual funds, pension funds, and other traditional delegated investment managers that are ubiquitous in the listed markets. Gutierrez and Pirinsky (2007) argue that momentum in listed markets partly arises because of agency issues in these delegated institutional managers. Thus, the lack of momentum in OTC stocks could be consistent with the absence of traditional delegated managers in OTC markets.

The weak idiosyncratic volatility effect in OTC markets after controlling for OTC market returns could also be related to the low information disclosure in these markets. Combining the Miller (1977) theory of overpricing and Kim and Verrecchia's (1991) model of information disclosure, one would correctly predict the observed volatility effects in both OTC and listed markets. By contrast, the weak volatility effect in OTC markets, where information is scarce and disclosures are infrequent, casts doubt on the hypothesis in Jiang, Xue, and Yao (2009) that selective corporate disclosures can explain the volatility effect in listed markets.

Our finding that OTC firms that disclose more information have higher future returns is somewhat unexpected and merits further study. Standard theories, such as Diamond and Verrecchia (1991), predict that increased disclosure should lower returns. One explanation for our opposite finding is that investors fail to realize that managers with negative inside information prefer to conceal this bad news to the extent possible. Combined with limits to arbitrage in OTC markets, this behavioral bias could lead to overpricing of OTC firms that choose not to disclose accounting information. This explanation is consistent with Dechow, Khimich, and Sloan's (2011) interpretation of the finding that firms with high discretionary accruals have low future returns. They argue that the accrual anomaly arises from investors' failure to understand that firms select accruals to present themselves in the best possible light.

An alternative explanation for the finding that more disclosure in OTC markets leads to lower returns is that increased disclosure leads to greater information asymmetry, which increases required rates of return, following Kim and Verrecchia (1994). Zhang (2001) shows that increased disclosure can increase costs of capital if the decision to disclose is driven by the costs of disclosure. Empirically, Botosan and Plumlee (2002) also show that greater disclosure is linked to higher returns for some types of disclosures in listed markets.

Finally, the return premiums that exist in OTC markets may offer insights into the future of listed markets. For example, the finding that size and value premiums exist in OTC markets provides more evidence that size and value effects are pervasive and systematic (*e.g.*, Asness, Moskowitz, and Pedersen, 2009). This suggests that size and value premiums are robust to differences in market structure and liquidity, and therefore may persist in the future.

The findings for the illiquidity premium (strong in OTC markets and relatively weak in listed markets) and for the momentum and volatility premiums (which exist only for listed stocks) may 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 are less transparent in the sense that their disclosures fail to resolve investor uncertainty about fundamentals, resulting in unusually low market liquidity. During such crises, stock prices in listed markets may reflect an illiquidity premium much like we observe in the highly illiquid OTC markets. A similar cross-market argument applies to the other return premiums. If the differences in information disclosure across listed and OTC markets explain the differences in the momentum and volatility premiums, the tendency toward greater disclosure in listed markets could actually exacerbate these two cross-sectional effects.

Appendix A: Correcting Observed Betas for Non-synchronous Trading

We correct stocks' observed betas for non-synchronous trading using the model presented 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 and independent 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

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

After extensive algebra, available upon request, we obtain the following relation between a 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 in a given month 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 obtain an estimate of stock i's true beta.

Appendix B: Correcting Average Returns for Bid-Ask Bounce Bias

This appendix models and estimates the impact of bid-ask bounce on expected returns for stocks (*i*) with different characteristics (*c*), such as firm size, at time *t*. The relevant characteristics are those that we use to rank stocks and form portfolios. For simplicity, we assume all stocks in a characteristic group have homogeneous attributes, such as bid-ask spreads and expected returns, but they may differ in their realization of bid-ask bounce. Our assumptions and notation follow Blume and Stambaugh (1983) as closely as possible.

We denote a stock's true price in each period using P_{ict} and its observed price $\widehat{P}_{ict}$ as

$$\widehat{P}_{ict} = (1+\delta_{ict})P_{ict}, \tag{8}$$

where the δ_{ict} are equally likely to be δ_c or $-\delta_c$, reflecting bid-ask bounce. We assume the δ_{ict} are independent across stocks and time. We define a stock's observed gross return ($\widehat{R}_{ict}$) to be

$$\widehat{R}_{ict} = \frac{\widehat{P}_{ict}}{\widehat{P}_{ict-1}} = \frac{(1+\delta_{ict})P_{ict}}{(1+\delta_{ict-1})P_{ict-1}}. \tag{9}$$

We assume that a stock's true gross return (R_{ict}) is independent across time and independent of δ_{ict} but not necessarily independent across stocks or characteristics:

$$R_{ict} = \frac{P_{ict}}{P_{ict-1}}. \tag{10}$$

To compare a stock's observed and expected returns, we evaluate the approximate expectation of Equation (9) using a first-order Taylor expansion around the (zero) mean of the bid-ask bounce term:

$$E(\widehat{R}_{ic}) = E\left[\frac{(1+\delta_{ict})P_{ict}}{(1+\delta_{ict-1})P_{ict-1}}\right] = E\left[\frac{1}{1+\delta_{ict-1}}\right]E[R_{ict}]$$
$$= E[1-\delta_{ict-1}+\delta_{ict-1}^{2}-\ldots]E[R_{ict}] \tag{11}$$
$$\approx (1+\delta_{c}^{2})E[R_{c}].$$

For a stock with a bid-ask spread of 20% ($\delta_c = 0.1$), this upward bias could cause a 1% increase in monthly expected returns. In an equally weighted portfolio with *N* stocks with the same characteristic *c*, the expected portfolio return ($\widehat{R^{e}}_{pct}$) is just as biased as the average individual stocks' expected return:

$$E[\widehat{R^{e}}_{pc}] = \frac{1}{N}\sum_{i} E[\widehat{R}_{ict}] = (1+\delta_{c}^{2})E[R_{c}]. \tag{12}$$

To distinguish the bid-ask bounce bias from a stock's true expected return, we assume each stock's expected return remains constant for at least two months. With this assumption, the bid-ask bounce bias affects a stock's observed one-month and observed two-month returns equally, but the stock's true expected return has twice as big an impact on its two-month returns. Formally, the stock's expected observed two-month gross return is

$$E[\widehat{R}_{ic2}] = E\left[\frac{\widehat{P}_{ict}}{\widehat{P}_{ict-2}}\right] = E\left[\frac{(1+\delta_{ict})}{(1+\delta_{ict-2})}\frac{P_{ict}}{P_{ict-1}}\frac{P_{ict-1}}{P_{ict-2}}\right] = E\left[\frac{(1+\delta_{ict})}{(1+\delta_{ict-2})}\right]E[R_{c}]^{2}$$
$$\approx (1+\delta_{c}^{2})E[R_{c}]^{2}. \tag{13}$$

Comparing Equations (11) and (13), we see that the ratio of the average two-month gross return to the average one-month gross return is an unbiased estimator of the stock's true gross return:

$$\frac{E(\widehat{R}_{ic2})}{E[\widehat{R}_{ic}]} = E[R_{c}]. \tag{14}$$

Using net returns, denoted using a lowercase *r*, this formula becomes

$$E[r_{c}] = \frac{1+E(\hat{r}_{ic2})}{1+E[\hat{r}_{ic}]} - 1. \tag{15}$$

To correct the returns of OTC stocks in characteristic-sorted portfolios, we estimate $E(\hat{r}_{ic2})$ and $E(\hat{r}_{ic})$ using the average returns on characteristic-sorted portfolios held for two months and one month, respectively. By substituting these two estimates in Equation (15), we obtain the implied estimates of true expected returns that appear in Table A1. For comparison purposes, Table A1 also displays the uncorrected estimates of OTC portfolios' expected returns originally reported in the column labeled Average Returns in Panel A of Table 5.

[Insert Table A1 here.]

In almost all cases, we cannot reject the hypothesis that the portfolios' corrected average returns are equal to their uncorrected average returns. None of the qualitative conclusions about the premiums for size, value, momentum, volatility, and illiquidity change. Even the quantitative results are similar. The largest correction applies to the portfolios sorted on Amihud's illiquidity measure. Specifically, the corrected illiquidity premium at 3.52% per month is significantly higher than the uncorrected premium at 1.43% per month. The magnitude of the corrected Amihud premium is also consistent with the illiquidity premiums on the other measures of illiquidity, such as bid-ask spreads, volume, and PNT (probability of non-trading).

To correct the Fama-MacBeth return predictability coefficients on firm characteristics, we use the weighted least squares (WLS) method described in Asparouhova, Bessembinder, and Kalcheva (2010). In each monthly regression, this WLS method applies a weight on each stock equal to its gross return in the previous month. Under the assumptions described in Asparouhova, Bessembinder, and Kalcheva (2010), this WLS method provides consistent estimates of return predictability coefficients even with bid-ask bounce. We report the time series averages of the monthly cross-sectional coefficients from these WLS regressions for OTC stocks in Table A2.

[Insert Table A2 here.]

The corrected coefficient estimates in Table A2 are qualitatively and quantitatively similar to the uncorrected estimates for OTC stocks in Panel A in Table 4 in the text. In particular, the key coefficients on firm size, book-to-market equity, volatility, momentum, and PNT exhibit the same signs, statistical significance, and overall economic magnitude. In all regression specifications, for each of these five variables, we cannot reject the hypothesis at the 5% level that the corrected and uncorrected coefficients are the same.

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.

Amihud, Y., H. Mendelson, and B. Lauterbach, 1997, Market Microstructure and Securities Values: Evidence from the Tel Aviv Stock Exchange, *Journal of Financial Economics* 45, 365-390.

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, 2009, Value and Momentum Everywhere, working paper, New York University.

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, 2001, 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.

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

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.

Bollen, N. P. B., and W. G. Christie, 2009, Market Microstructure of the Pink Sheets, *Journal of Banking and Finance* 33, 1326-1339.

Botosan, C. A., and M. A. Plumlee, 2002, A Re-Examination of Disclosure Level and the Expected Cost of Equity Capital, *Journal of Accounting Research* 40, 21-40.

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.

Daniel, K., and S. Titman, 1997, Evidence on the Characteristics of Cross Sectional Variation in Stock Returns, *Journal of Finance* 52, 1-33.

Dechow, P. M., N. V. Khimich, and R. G. Sloan, 2011, The Accrual Anomaly, working paper, UC Berkeley.

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

Diether, K. B., C. J. Malloy, and A. Scherbina, 2002, Differences of Opinion and the Cross Section of Stock Returns, *Journal of Finance* 57, 2113-2141.

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.

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.

Gervais, S., R. Kaniel, and D. H. Mingelgrin, 2001, The High-Volume Return Premium, *Journal of Finance* 56, 877-919.

Glosten, L. R. and P. R. Milgrom, 1985, Bid, Ask, and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders, *Journal of Financial Economics* 14, 71-100.

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.

Hendershott, T., and C. M. Jones, 2005, Island Goes Dark: Transparency, Fragmentation, and Regulation, *Review of Financial Studies* 18, 743-793.

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.

Jagannathan, R. and Z. Wang, 1996, The Conditional CAPM and the Cross-Section of Expected Returns, *Journal of Finance* 51, 3-53.

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

Jiang, G. J, D. Xu, and T. Yao, The Information Content of Idiosyncratic Volatility, *Journal of Financial and Quantitative Analysis* 44, 1-28.

Kim, O. and R. E. Verrecchia, 1991, Trading Volume and Price Reactions to Public Announcements, *Journal of Accounting Research* 29, 302-321.

Kim, O., and R. E. Verrechia, 1994, Market Liquidity Around Earnings Announcements, *Journal of Accounting and Economics* 17, 41-67.

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, An Econometric Analysis of Nonsynchronous Trading, *Journal of Econometrics* 45, 181-211.

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.

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.

Roll, R., 1984, A Simple Implicit Measure of the Effective Bid-Ask Spread in an Efficient Market, *Journal of Finance,* 39, 1127-1139.

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

Silber, W., 1991, Discounts on Restricted Stock: The Impact of Illiquidity on Stock Prices, *Financial Analysts Journal* 47, 60-64.

Sloan, R. G., 1996, Do Stock Prices Fully Reflect Information in Accrual and Cash Flows about Future Earnings? *Accounting Review* 71, 289-315.

Zhang, G., 2001. Private Information Production, Public Disclosure, and the Cost of Capital: Theory and Implications, *Contemporary Accounting Research* 18, 363-384.

Zhang, L., 2005, The Value Premium, *Journal of Finance* 60, 67-103.

Table 1: Summary Statistics for the OTC and Listed Samples in March 2000

We report statistics for size, volume, and the number of firms in the OTC, comparable listed, and eligible listed samples in March of 2000, which is the peak month for OTC trading volume. By design, the comparable listed sample has 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)	89.2	37.7	16,691
Median Market Capitalization (Millions)	21.2	21.2	169
Mean Market Capitalization (Millions)	71.9	22.2	2,558
Trading Volume (Annualized Billions)	141.6	95.0	42,027
Median Trading Volume (Annualized Millions)	9.9	15.0	272
Mean Trading Volume (Annualized Millions)	113.9	55.9	6,444
Number of Firms	1,240	1,700	6,524

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

We list 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%
SECURITY NATL CORP IOWA	Jan-01	OTCBB	62.0	50th	99.2%
KISH BANCORP INC	Sep-08	Pink Sheets	44.1	48th	98.8%
HARFORD BANK	Apr-02	OTCBB	27.2	83rd	98.4%
UMEMBER.COM INC	Mar-00	OTCBB	25.4	116th	98.2%
DELAWARE BANCSHARES INC	Aug-08	Pink Sheets	18.9	159th	96.2%
DELPHI CORP	Feb-08	Pink Sheets	13.0	232nd	94.7%
COMDISCO HLDG CO INC	Dec-02	OTCBB	11.7	144th	96.9%
ASB FINL CORP	Aug-05	Pink Sheets	11.5	251st	94.6%
SKYTOP LODGE CORP	Sep-08	Pink Sheets	9.3	253rd	93.9%

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. The comparable sample consists of stocks that are comparable to stocks in the OTC sample in terms of size, as described in Section I.C. 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. We compute these statistics separately for each month and then average across all months. 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 for which we have any non-missing data values of each variable in each month.

Panel A: OTC Stocks

	Monthly Averages								Total
Variable	Mean	SD	P5	P25	P50	P75	P95	Firms	Months
Return (%)	-0.25	27.87	-34.80	-10.03	-1.29	4.70	37.58	487	384
Disclose	0.52	0.48	0.00	0.00	0.52	1.00	1.00	487	384
Size	2.42	1.30	0.22	1.44	2.38	3.38	4.77	487	384
B/M	1.12	2.36	0.06	0.29	0.70	1.27	3.27	218	384
Volatility	6.83	6.10	0.80	2.36	4.97	9.05	23.32	459	384
Volume	8.59	3.73	4.46	5.67	7.73	11.53	14.92	487	384
Amihud	1.88	1.50	0.10	0.60	1.52	2.92	4.88	448	384
PNT	0.53	0.35	0.00	0.24	0.60	0.82	0.94	487	384
Spread	0.13	0.11	0.02	0.04	0.09	0.18	0.42	383	192

Panel B: Comparable Listed Sample

	Monthly Averages								Total
Variable	Mean	SD	P5	P25	P50	P75	P95	Firms	Months
Return (%)	0.69	19.30	-24.20	-8.90	-1.18	7.27	31.94	1130	384
Disclose	0.82	0.36	0.21	0.63	1.00	1.00	1.00	1146	384
Size	2.27	0.55	1.11	1.90	2.38	2.74	2.98	1130	384
B/M	1.27	1.62	0.18	0.53	0.95	1.55	3.23	865	384
Volatility	4.25	2.10	1.22	2.63	3.93	5.53	8.88	1114	384
Volume	10.84	2.01	8.15	9.53	10.32	12.44	14.35	1130	384
Amihud	1.89	1.03	0.41	1.04	1.74	2.62	3.98	958	384
PNT	0.19	0.21	0.00	0.02	0.11	0.31	0.66	1130	384
Spread	0.07	0.04	0.02	0.04	0.06	0.10	0.17	602	303

Table 4: Cross-Sectional Regressions of Monthly Returns on Firm Characteristics

This table displays estimates of cross-sectional regressions of monthly stock returns on several firm characteristics and factor loadings. We compute Fama and Macbeth (1973) coefficients by estimating monthly cross-sectional regressions and weighting the monthly coefficients by the inverse of their squared standard errors as in Ferson and Harvey (1999). We compute standard errors using the estimator in Newey and West (1987) with the number of lags equal to the recommendation in Newey and West (1994). This number of lags is four for Regression III and five for all other regressions. 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. The ‡ symbol denotes the regression that only uses data from 1993 to 2008. All other regressions include data from 1977 through 2008.

Table 4 Continued

Panel A: OTC Sample

	I	II	III‡	IV	V	VI	VII
β_{MKT}	-0.159**	-0.159**				-0.070	-0.075*
	(0.043)	(0.042)				(0.037)	(0.036)
β_{SMB}	-0.136**	-0.142**				-0.032	-0.033
	(0.029)	(0.027)				(0.022)	(0.022)
β_{HML}	0.069*	0.086*	0.015			0.027	0.026
	(0.033)	(0.034)	(0.021)			(0.025)	(0.025)
β_{UMD}	0.046	0.043				0.036	0.031
	(0.027)	(0.027)				(0.028)	(0.029)
Size		-0.516**	-0.876**		-0.853**	-0.902**	-0.955**
		(0.110)	(0.108)		(0.115)	(0.112)	(0.113)
B/M			0.806**				
			(0.133)				
Volatility			-0.204**		-0.205**	-0.197**	-0.192**
			(0.022)		(0.020)	(0.020)	(0.020)
Ret[-1]		-0.017**	-0.013*		-0.018**	-0.018**	-0.018**
		(0.006)	(0.006)		(0.006)	(0.006)	(0.006)
Ret[-12,-2]		0.0000	0.002		0.002	0.002	0.002
		(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Volume				-0.606**	-0.151	-0.090	-0.088
				(0.105)	(0.102)	(0.098)	(0.098)
Amihud				-0.627**	-0.199	-0.170	-0.205
				(0.106)	(0.112)	(0.115)	(0.118)
PNT				5.054**	6.083**	6.063**	7.689**
				(0.836)	(0.841)	(0.821)	(0.939)
Disclose							1.734**
							(0.322)
PNT*Disclose							-2.036**
							(0.766)
Average R^2	0.062	0.113	0.105	0.070	0.191	0.284	0.317
Avg Stocks	392	372	371	448	340	339	339

Table 4 Continued

Panel B: Comparable Listed Sample

	I	II	III‡	IV	V	VI
β_{MKT}	-0.175**	-0.124				-0.049
	(0.068)	(0.070)				(0.053)
β_{SMB}	-0.103**	-0.089*				-0.040
	(0.036)	(0.038)				(0.029)
β_{HML}	0.042	0.033	0.005			0.011
	(0.037)	(0.035)	(0.038)			(0.029)
β_{UMD}	0.004	-0.028				-0.009
	(0.027)	(0.026)				(0.030)
Size		-0.479**	-0.819**		-0.819**	-0.812**
		(0.079)	(0.178)		(0.105)	(0.104)
B/M			0.837**			
			(0.130)			
Volatility			-0.318**		-0.399**	-0.391**
			(0.089)		(0.042)	(0.039)
Ret[-1]		-0.057**	-0.054**		-0.057**	-0.058**
		(0.006)	(0.008)		(0.006)	(0.006)
Ret[-12,-2]		0.016**	0.019**		0.016**	0.016**
		(0.002)	(0.002)		(0.001)	(0.001)
Volume				0.096	0.397**	0.399**
				(0.091)	(0.078)	(0.077)
Amihud				-0.193**	0.354**	0.344**
				(0.051)	(0.062)	(0.062)
PNT				2.213**	0.966*	0.936**
				(0.487)	(0.382)	(0.359)
Average R^2	0.014	0.030	0.037	0.017	0.039	0.050
Avg Stocks	1013	998	759	958	853	854

Table 4 Continued

Panel C: Eligible Listed Sample

	I	II	III‡	IV	V	VI
β_{MKT}	-0.272**	-0.223**				-0.103
	(0.086)	(0.080)				(0.057)
β_{SMB}	-0.165**	-0.148**				-0.068*
	(0.052)	(0.043)				(0.031)
β_{HML}	0.188**	0.158**	0.066			0.089*
	(0.061)	(0.052)	(0.039)			(0.038)
β_{UMD}	0.044	0.014				0.020
	(0.028)	(0.025)				(0.025)
Size		-0.031	-0.115*		-0.199**	-0.229**
		(0.039)	(0.046)		(0.061)	(0.055)
B/M			0.539**			
			(0.109)			
Volatility			-0.381**		-0.517**	-0.483**
			(0.105)		(0.062)	(0.048)
Ret[-1]		-0.042**	-0.025**		-0.038**	-0.041**
		(0.005)	(0.007)		(0.005)	(0.005)
Ret[-12,-2]		0.010**	0.011**		0.010**	0.010**
		(0.001)	(0.002)		(0.002)	(0.001)
Volume				0.000	0.070	0.103**
				(0.031)	(0.043)	(0.036)
Amihud				-0.395**	0.303**	0.283**
				(0.072)	(0.059)	(0.059)
PNT				2.478**	0.055	0.031
				(0.536)	(0.300)	(0.266)
Average R^2	0.024	0.043	0.049	0.017	0.049	0.058
Avg Stocks	4809	4762	5140	4826	4407	4412

Table 5: Time Series Analysis of OTC Factor Portfolios

This table summarizes the returns and risk of several long-short factor portfolios constructed using OTC stocks. To construct each factor, we sort OTC firms into quintiles at the end of each month based on the firm characteristics in the OTC Factor column. A factor return for month *t* is the difference between the equal-weighted returns of firms in the top and bottom quintiles for that factor, as ranked in month *t-1*. We require at least 10 firms in each quintile. We estimate time series regressions of the monthly OTC factor returns on various contemporaneous return factors and six lags of these factors to account for non-synchronous trading as in Dimson (1979). We compute standard errors using the estimator in Newey and West (1987) with the number of lags equal to the recommendation in Newey and West (1994). We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively. The ‡ symbol denotes the value factor portfolio, which only uses data from 1993 to 2008. All other factor portfolios include data from 1977 through 2008.

The first column in Panel A reports average monthly returns on the OTC factors. The next three columns report intercepts (alphas) from three time series regressions with different regressors. In the OTC CAPM and Listed CAPM columns, the only regressors are the value-weighted OTC market excess return and the listed MKT factor, respectively. In the Listed 5-Factor column, the regressors include the listed MKT, SMB, HML, and UMD factors from Carhart (1997) and the liquidity factor in Pastor and Stambaugh (2003). The last two columns in Panel A report annualized Sharpe ratios for OTC factors and for analogous factors based on 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.

Table 5 Continued

Panel A: Evaluating OTC Factor Returns

	Average	Alphas by Model			Annualized Sharpe Ratios	
	Monthly	OTC	Listed	Listed		Comparable
OTC factor	Returns	CAPM	CAPM	5-Factor	OTC	Listed
PNT	3.270**	2.331**	4.030**	3.977**	1.169**	0.090
	(0.584)	(0.567)	(0.535)	(0.770)	(0.209)	(0.191)
Volume	-3.044**	-2.615**	-3.521**	-3.069**	-1.307**	0.059
	(0.530)	(0.517)	(0.557)	(0.692)	(0.228)	(0.178)
Spread	3.455**	4.168**	3.182**	3.327**	1.626**	-0.751**
	(0.702)	(0.704)	(0.728)	(1.082)	(0.331)	(0.201)
Amihud	1.637*	2.308**	1.284	0.916	0.642*	-0.104
	(0.743)	(0.852)	(0.739)	(1.045)	(0.291)	(0.181)
Size	-3.724**	-3.606**	-3.670**	-3.999**	-1.393**	-0.975**
	(0.564)	(0.694)	(0.535)	(0.717)	(0.211)	(0.208)
Value‡	3.199**	1.826**	3.822**	3.502**	1.312**	1.183**
	(0.679)	(0.697)	(0.609)	(0.929)	(0.278)	(0.209)
Momentum	0.587	0.460	1.067*	-0.210	0.235	1.247**
	(0.476)	(0.529)	(0.437)	(0.664)	(0.191)	(0.154)
Volatility	-1.304*	-0.237	-2.093**	-1.511*	-0.481*	-0.527**
	(0.602)	(0.586)	(0.506)	(0.689)	(0.222)	(0.199)

Table 5 Continued

Panel B: Systematic Variation in OTC Return Factors

The first six columns of Panel B report beta coefficients on factors from the three time series regressions described in Panel A. The first and second columns reports the univariate coefficients of each OTC factor on the OTC value-weighted market excess return and on the listed MKT factor, respectively. The next four columns report beta coefficients of each OTC factor on the listed SMB, HML, and UMD factors and the Pastor-Stambaugh liquidity factor from the five-factor regression. Each beta coefficients on a factor is the sum of estimated regression coefficients on the contemporaneous factor and its six lags. The last three columns in Panel B report the R^2 statistics from the three time series regressions.

	Factor Loadings						R^2 by Model		
OTC Factor	β_{OMKT}	β_{MKT}	β_{SMB}	β_{HML}	β_{UMD}	β_{LIQ}	OTC CAPM	Listed CAPM	Listed 5-Factor
PNT	-0.992**	-1.369**	-0.888*	0.659	-0.223	0.314	0.193	0.199	0.398
	(0.234)	(0.283)	(0.402)	(0.463)	(0.384)	(0.366)			
Volume	0.541*	0.759*	0.631	-0.929*	0.092	-0.425	0.129	0.152	0.388
	(0.264)	(0.335)	(0.403)	(0.371)	(0.351)	(0.324)			
Spread	0.491	0.615	0.76	0.24	0.06	-0.583	0.057	0.048	0.147
	(0.296)	(0.339)	(0.504)	(0.464)	(0.442)	(0.496)			
Amihud	0.509	1.095**	1.292*	-0.082	-0.047	0.245	0.096	0.078	0.232
	(0.294)	(0.409)	(0.519)	(0.511)	(0.465)	(0.578)			
Size	0.184	-0.207	-0.494	0.543	-0.113	0.228	0.048	0.029	0.108
	(0.252)	(0.337)	(0.559)	(0.561)	(0.432)	(0.396)			
Value	-0.897**	-1.447**	-0.103	0.719*	-0.374	0.702	0.199	0.134	0.360
	(0.22)	(0.361)	(0.384)	(0.358)	(0.392)	(0.64)			
Momentum	-0.284	-0.605*	-0.279	0.546	0.976**	0.291	0.029	0.054	0.190
	(0.199)	(0.248)	(0.357)	(0.428)	(0.351)	(0.374)			
Volatility	1.079**	1.509**	0.799	-0.639	0.381	-1.177**	0.268	0.161	0.358
	(0.19)	(0.295)	(0.423)	(0.422)	(0.362)	(0.354)			

Table 6: Time Series Regression of the OTC Market on Listed Return Factors

This table reports the estimates from three time series regressions of the monthly OTC factor returns on various listed return factors from 1977 through 2008. The next three columns report intercepts (alphas) from three time series regressions with different regressors. In the Raw Return column, there are no regressors. In the Listed CAPM column, the only regressor is the listed MKT factor. In the Listed 5-Factor column, the regressors include the listed MKT, SMB, HML, and UMD factors from Carhart (1997) and the liquidity factor in Pastor and Stambaugh (2003). The first row reports the intercepts (alpha) from each regression, while the next five rows report the beta coefficients on each of the five listed factors. Each beta coefficients on a factor is the sum of estimated regression coefficients on the contemporaneous factor and its six lags. The last row reports the R^2 statistics from the three time series regressions. We compute standard errors using the estimator in Newey and West (1987) with the number of lags equal to the recommendation in Newey and West (1994). We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively.

Coefficient	Raw Return	Listed CAPM	Listed 5-Factor
α	-1.030**	-1.466**	-1.518**
	(0.317)	(0.241)	(0.321)
β_{MKT}		0.903**	0.852**
		(0.123)	(0.169)
β_{SMB}			0.395*
			(0.184)
β_{HML}			0.043
			(0.211)
β_{UMD}			0.026
			(0.169)
β_{LIQ}			-0.102
			(0.168)
R^2		0.288	0.432

Table 7: Contemporaneous Correlations between Detrended OTC and Listed Liquidity

This table displays correlations between detrended average liquidity in the OTC sample and detrended average liquidity in the two listed samples from 1977 through 2008. We define detrended average liquidity in each month as the equal-weighted average *PNT* value in that month minus the mean equal-weighted average *PNT* in the previous three months. A stock's monthly *PNT* value is the fraction of non-trading days in that month. We compute correlations for five subperiods and for the entire sample period. We select cutoff points for the subperiods to coincide with four possible structural breaks in the listed and OTC average liquidity measures. Before detrending the average liquidity time series, we remove these breaks as described in Section V.B. 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.

Time Period	OTC versus Comparable Listed	OTC versus Eligible Listed
Full Sample	0.38	0.24
1/77-10/82	0.18	0.14
11/82-5/87	0.38	-0.13
6/87-9/90	0.72	0.77
10/90-7/95	0.03	0.12
8/95-12/08	0.69	0.69

Table 8: VAR with OTC and Listed Liquidity

We estimate VARs of detrended average liquidity in the OTC, comparable listed, and eligible listed samples from 1977 through 2008. We define detrended average liquidity in each month as the equal-weighted average *PNT* value in that month minus the mean equal-weighted average *PNT* in the previous three months. A stock's monthly *PNT* value is the fraction of non-trading days in that month. Before detrending liquidity, we remove four possible structural breaks from the time series of average *PNT* values as described in Section V.B. 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.

Panel A presents results from a VAR of detrended average liquidity measures in the OTC and comparable listed samples. Panel B presents results from an identical VAR with liquidity in the OTC and the eligible listed samples. Both VARs include three monthly lags for each variable. The six columns report the three coefficients on each of these two sets of lagged variables. The last column reports the R^2 statistics from the three time series regressions. We compute standard errors using the estimator in Newey and West (1987) with the number of lags equal to the recommendation in Newey and West (1994). We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively.

Panel A: Average Detrended PNT in the OTC and the Comparable Listed Sample (CLS)

Dependent Variable	Independent Variables						
	Lag1($APNT_{OTC}$)	Lag2($APNT_{OTC}$)	Lag3($APNT_{OTC}$)	Lag1($APNT_{CLS}$)	Lag2($APNT_{CLS}$)	Lag3($APNT_{CLS}$)	R^2
$APNT_{OTC}$	0.301**	0.055	-0.185**	-0.124	0.043	0.029	0.107
	(0.089)	(0.085)	(0.065)	(0.07)	(0.059)	(0.08)	
$APNT_{CLS}$	0.041	-0.009	-0.012	0.113	0.069	-0.207**	0.063
	(0.064)	(0.077)	(0.058)	(0.092)	(0.075)	(0.065)	

Table 8 Continued

Panel B: Average Detrended PNT in the OTC and the Eligible Listed Sample (ELS)

Dependent Variable	Independent Variables						
	Lag1($APNT_{OTC}$)	Lag2($APNT_{OTC}$)	Lag3($APNT_{OTC}$)	Lag1($APNT_{ELS}$)	Lag2($APNT_{ELS}$)	Lag3($APNT_{ELS}$)	R^2
$APNT_{OTC}$	0.285**	0.062	-0.189**	-0.352	0.143	0.113	0.106
	(0.09)	(0.089)	(0.064)	(0.232)	(0.219)	(0.177)	
$APNT_{ELS}$	0.001	-0.015	0.002	0.33**	0.006	-0.214**	0.151
	(0.018)	(0.02)	(0.014)	(0.095)	(0.099)	(0.073)	

Table A1: Correcting for the Bid-Ask Bounce Bias in OTC Factor Portfolio Returns

This table summarizes the returns and risk of several long-short factor portfolios constructed using OTC stocks. To construct each factor, we sort OTC firms into quintiles at the end of each month based on the firm characteristics in the OTC Factor column. A factor return for month *t* is the difference between the equal-weighted returns of firms in the top and bottom quintiles for that factor, as ranked in month *t-1*. We require at least 10 firms in each quintile. The second column in Panel A reports the raw average monthly returns on the OTC factors, which are also reported in Panel A in Table 5. The ‡ symbol denotes the value factor portfolio, which only uses data from 1993 to 2008. All other factor portfolios include data from 1977 through 2008.

The first column in Panel A uses the method described in Appendix A to correct raw returns for the bias in average returns induced by bid-ask bounce. We compute corrected returns using Equation (15), which requires two inputs. The first input is the raw one-month portfolio return described above and the second input is an analogous portfolio return computed using a two-month holding period for each equally weighted stock. We compute standard errors for the raw monthly returns using the estimator in Newey and West (1987) with the number of lags equal to the recommendation in Newey and West (1994). We use the delta method to obtain the standard errors for the corrected monthly returns. We denote statistical significance at the 5% and 1% levels using * and ** symbols, respectively.

OTC factor	Corrected Monthly Returns	Raw Monthly Returns
PNT	3.366**	3.270**
	(0.566)	(0.584)
Volume	-4.415**	-3.044**
	(0.547)	(0.530)
Spread	5.353**	3.455**
	(0.680)	(0.702)
Amihud	4.596**	1.637*
	(0.732)	(0.743)
Size	-5.064**	-3.634**
	(0.608)	(0.585)
Value‡	1.415*	3.199**
	(0.658)	(0.679)
Momentum	0.114	0.587
	(0.473)	(0.476)
Volatility	-0.356	-1.304*
	(0.610)	(0.602)

Table A2: Correcting for the Bid-Ask Bounce Bias in OTC Regression Estimates

This table displays corrected estimates of cross-sectional regressions of monthly stock returns on several firm characteristics and factor loadings for OTC stocks. One can compare these corrected estimates to those in Table 4, Panel A, which shows the uncorrected estimates for OTC stocks. 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 weigh each monthly coefficient by the inverse of its squared standard error as in Ferson and Harvey (1999). We compute standard errors using the estimator in Newey and West (1987) with the number of lags equal to the recommendation in 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. The ‡ symbol denotes the regression that only uses data from 1993 to 2008. All other regressions include data from 1977 through 2008.

	I	II	III‡	IV	V	VI
β_{MKT}	-0.126*	-0.124*				-0.025
	(0.057)	(0.055)				(0.045)
β_{SMB}	-0.161**	-0.132**				-0.025
	(0.043)	(0.040)				(0.033)
β_{HML}	0.089*	0.092*	0.004			0.032
	(0.043)	(0.043)	(0.034)			(0.037)
β_{UMD}	0.033	0.033				0.044
	(0.056)	(0.059)				(0.061)
Size		-0.399**	-0.971**		-1.038**	-1.004**
		(0.120)	(0.189)		(0.233)	(0.201)
B/M			0.819**			
			(0.163)			
Volatility			-0.215**		-0.180**	-0.186**
			(0.033)		(0.031)	(0.030)
Ret[-1]		-0.067**	-0.049**		-0.043**	-0.040**
		(0.010)	(0.010)		(0.007)	(0.007)
Ret[-12,-2]		0.0010	0.003		0.003	0.003
		(0.002)	(0.002)		(0.002)	(0.002)
Volume				-0.949*	-0.127	-0.147
				(0.387)	(0.189)	(0.148)
Amihud				-1.066**	-0.739**	-0.671**
				(0.330)	(0.217)	(0.184)
PNT				4.444**	4.933**	4.585**
				(1.536)	(1.054)	(0.978)
Average R^2	0.088	0.152	0.098	0.102	0.224	0.321
Avg Stocks	388	372	647	435	340	339

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

For each month, we plot the median size, median trading volume, and number of stocks in the OTC sample as a percentage of the corresponding statistics in the eligible listed sample. We plot the ratio of means rather than ratio of medians for volume prior to July 1995 because volume data are less reliable before 1995. The eligible listed sample consists of the CRSP stocks satisfying the same data requirements as the OTC sample described in Section I.B.

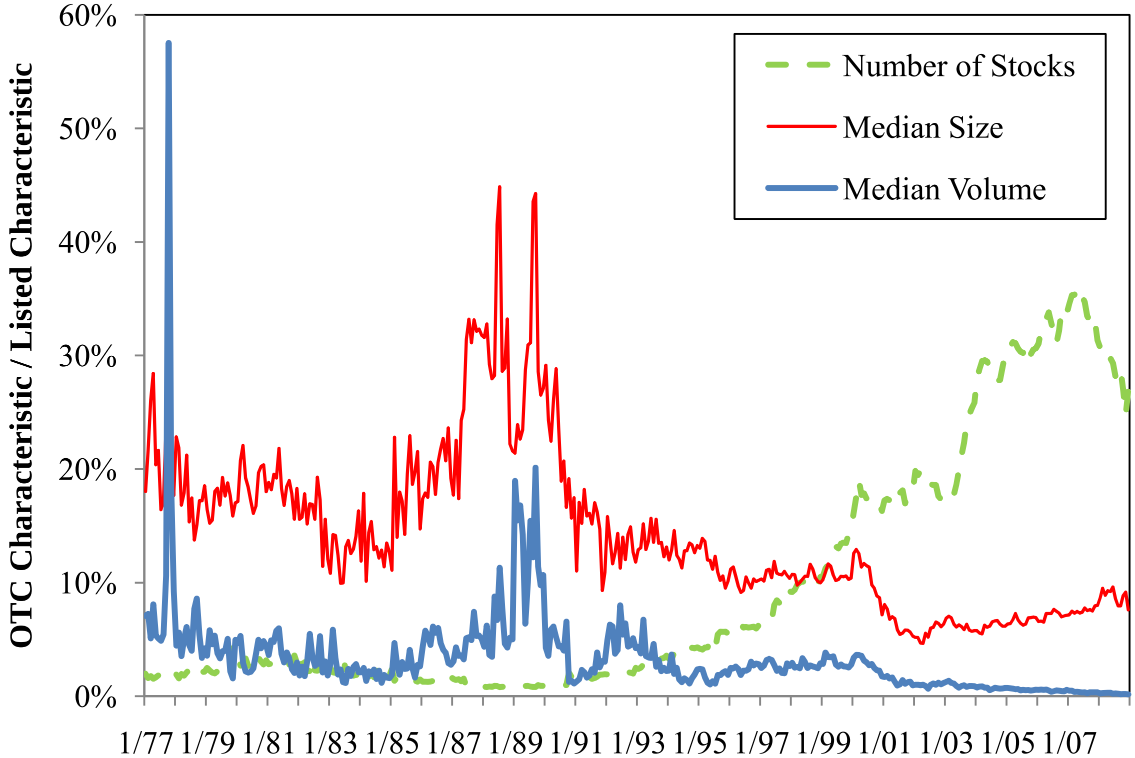

Figure 2: Listed Percentiles Corresponding to the 50th, 75th, 90th, and 99th OTC Percentiles

This figure compares the size of firms in the eligible listed and OTC samples in each month from 1977 to 2008. The four lines represent the four size percentiles in the eligible listed sample that correspond to the firms ranked at the 50th, 75th, 90th and 99th percentiles of size in the OTC sample in each month. The eligible listed sample consists of all listed stocks that satisfy the same data requirements as the OTC sample described in Section I.B.

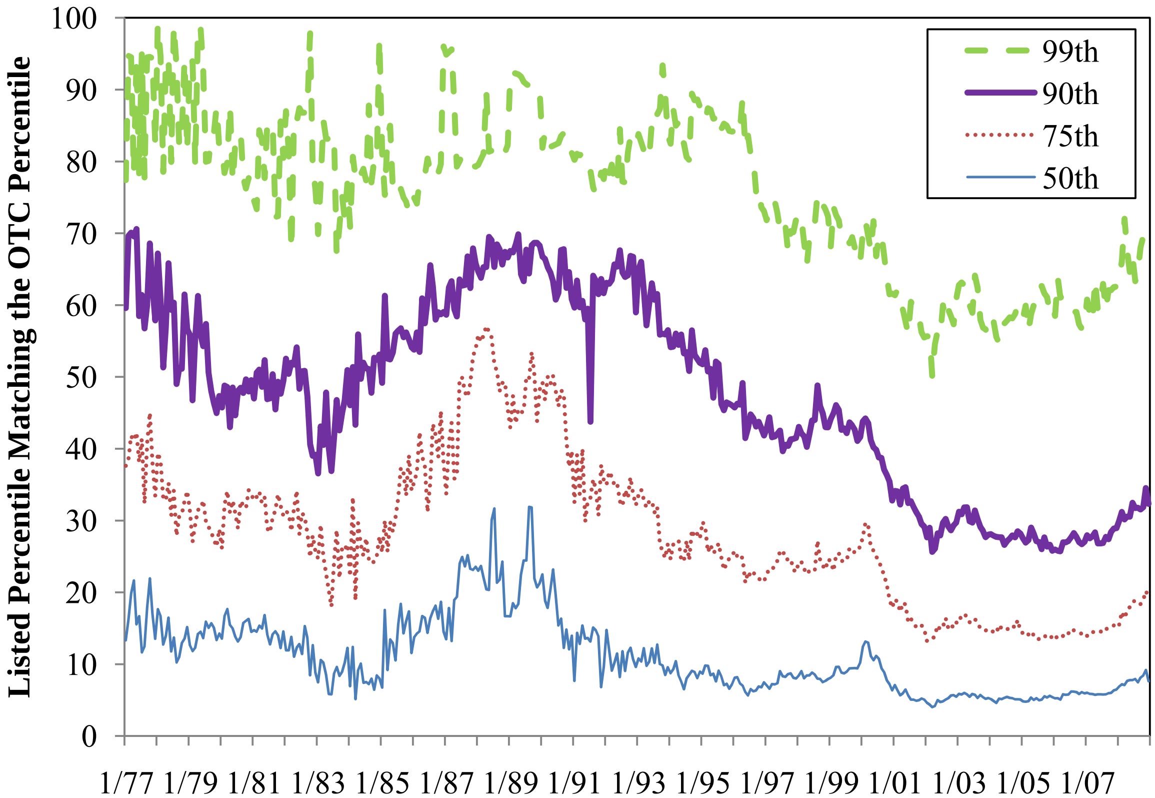

Figure 3A: The Value of $1 Invested in Illiquidity Factors

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. For all three markets, we construct factors by sorting 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 equal-weighted returns of firms in the top and bottom *PNT* quintiles. We also plot the cumulative return on the Pastor-Stambaugh liquidity 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.

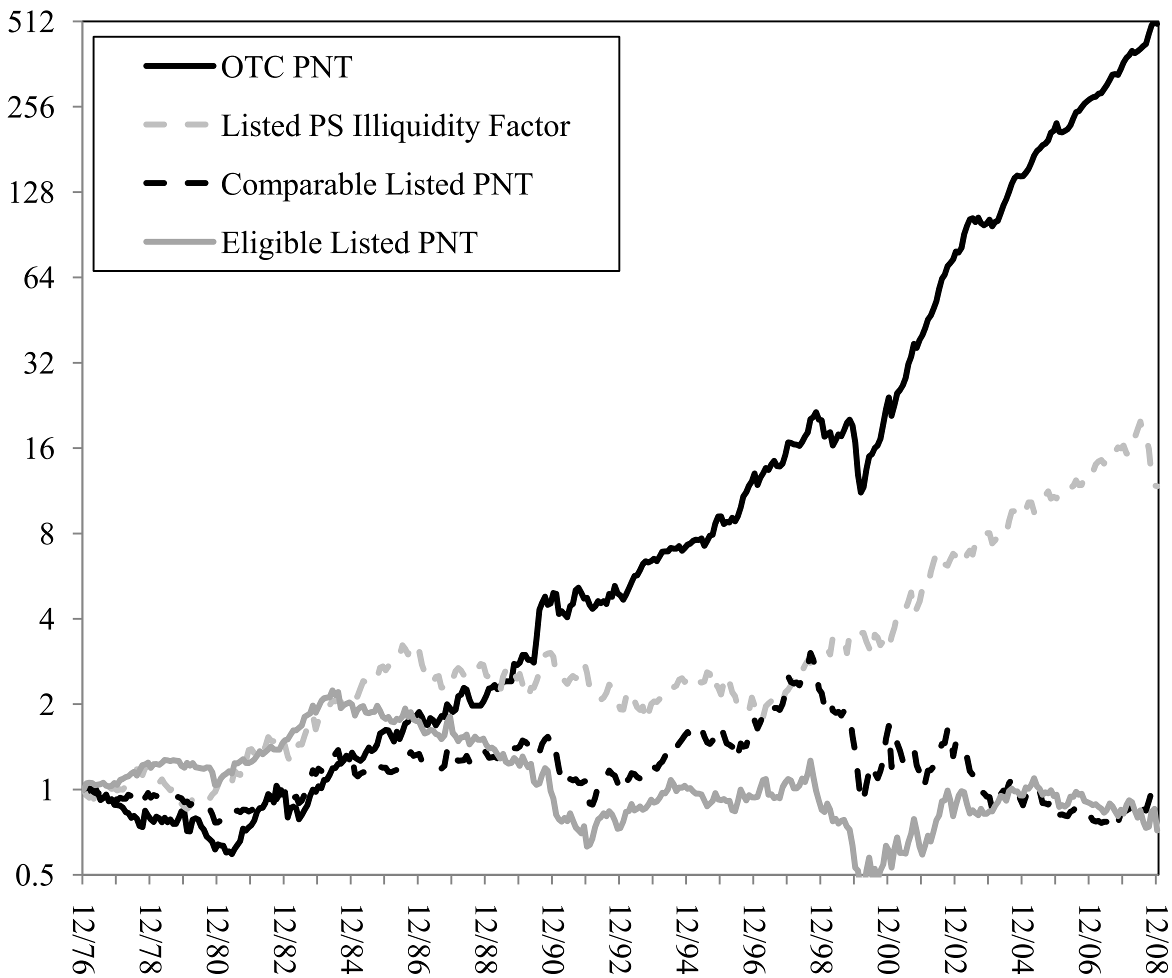

Figure 3B: The Value of $1 Invested in Size and Value Factors

We plot the cumulative returns for size and value (*B/M*) factors in the OTC and comparable 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 size and value factors from both markets. We construct factors by sorting stocks into quintiles according to either their monthly size or *B/M* values, where the *B/M* variable representing value is the ratio of a firm's book equity to its market equity. Each factor return is the difference between the equal-weighted returns of firms in the top and bottom quintiles. 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. We only compute the return on the value factors after 1993 because there are an insufficient number of OTC firms with book equity data before 1993.

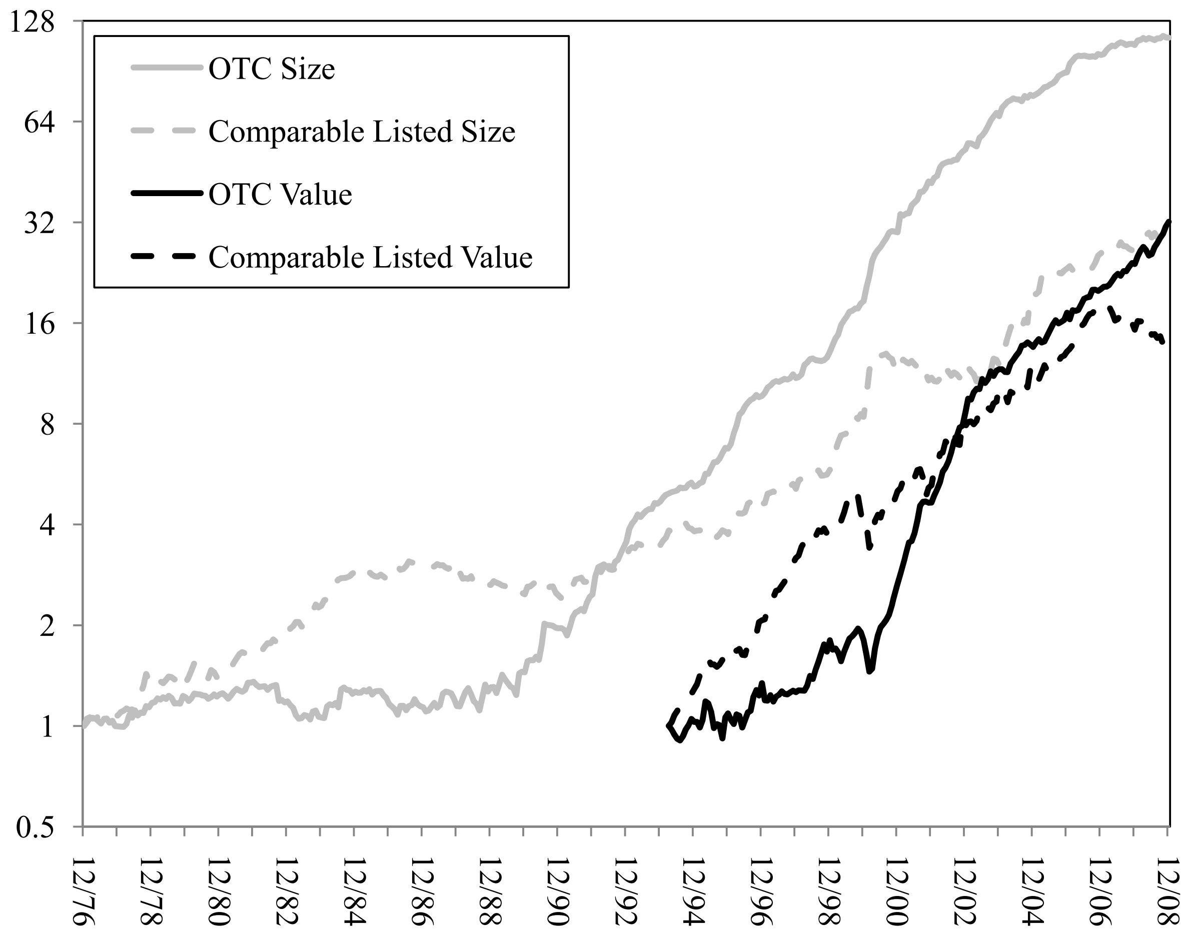

Figure 4: Average Fraction of Non-Trading Days for the OTC and Listed Samples

We plot average monthly *PNT* values for the OTC , comparable listed, and eligible listed samples, where a stock's monthly *PNT* value is the fraction of non-trading days in that month. We remove four possible structural breaks in the time series of average *PNT* values for the OTC and listed samples, as described in Section V.B. 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.