Trading Activity, Illiquidity Costs and Stock Returns[*]

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ABSTRACT

This paper analyzes the ability of trading activity to explain cross-sectional variation in expected stock returns. We depart from the previous literature in not taking for granted that turnover is solely a proxy for liquidity. Instead, we test the impact of trading activity on monthly stock returns, after controlling for the usual factors (firm size, book-to-market-ratio and momentum) and for illiquidity costs. We estimate illiquidity costs (price impact of a trade) using intraday data from 1993 to 2002 for a large sample of NYSE and Nasdaq stocks. The results for the entire sample period provide evidence that higher turnover rates are associated with lower future returns after controlling for these costs. We also find evidence that the effect of illiquidity costs is related to firm size. Yet, for large and glamour stocks, which are very liquid, the effect of trading activity is still statistically and economically significant. During the dot-com period of 1998-2000, we observe that the turnover effect is highly volatile across months and it is not significantly negative. These findings call into question the presumption that trading activity is solely a proxy for liquidity.

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1 Introduction

Turnover is often used in practice to predict future variation in asset returns. At the same time, according to many observers, trading volume seems to be too high in financial markets.[1] The interaction between these two facts raises a question about how past levels of trading activity are interpreted by investors when predicting cross-sectional returns and to which extent measures of turnover convey important information about a security.

There is substantial empirical evidence documented in the literature supporting a strong and negative relationship between past trading activity levels and cross-sectional returns for short and long horizons. Datar et al. (1998) show that on average, a 1% drop in turnover rates increases the required rate of return by 4.5 basis points per month in a large sample of NYSE stocks during the period of 1962-1991. Brennan et al. (1998), using dollar volume as a proxy for trading activity, also find a significant and negative effect of volume on monthly returns for a sample covering 1966-1995. Lee and Swaminathan (2000) show that this effect is also observed for longer horizons. Controlling for price momentum, they show that low volume stocks outperform high volume stocks for each of the next five years after the portfolio formation, using a sample of NYSE/AMEX stocks from 1966-1995.[2]

The standard explanation provided by the literature links the observed trading activity effect with liquidity. According to the liquidity-based theory, stocks with low levels of trading volume are less liquid and hence command higher returns. Investors require a premium for holding less liquid assets since they anticipate the payment of higher trading costs when reselling the asset in the future. Therefore, illiquidity acts as a tax on trading that is reflected in equilibrium prices.[3] In the microstructure literature, trading costs are due to adverse selection problems,[4] inventory holding costs,[5] order processing and market making profits and hence, alternative measures of illiquidity can be con-

[1] As an example, the reported dollar trading volume on NYSE in 2003 was U.S.$9.7 trillion.

[2] This result holds for portfolios in the lowest quintiles of past returns (past losers). Low volume winners outperform high volume winners from the second to the fifth year.

[3] There is also recent empirical literature relating returns and liquidity risk. See, for example, Chordia and Subrahmanyam (2001), Acharya and Pedersen (2005) and Pastor and Stambaugh (2003).

[4] As in Kyle (1985), Glosten and Milgrom (1985), Easley and O'Hara (1987) and Admati and Pleiferer (1988).

[5] As in Stoll (1978) and Amihud and Mendelson (1980).

structed. The effect of liquidity on cross-sectional returns is empirically investigated in the literature using alternative measures, such as bid-ask spreads (Amihud and Mendelson (1986), Elswarapu and Reinganum, (1993)) and price impact of a trade (Brennan and Subrahmanyam (1996), Glosten and Harris (1988)). In most of the studies, the empirical evidence supports the existence of an illiquidity premium on returns.

However, the use of trading activity as a liquidity proxy, although extremely convenient in terms of available data,[6] is questionable. The magnitude of the reported effects of trading activity on cross-sectional returns seems to be too high to be driven solely by liquidity reasons. Moreover, recent empirical findings suggest an alternative explanation to the liquidity-based theory, indicating that higher levels of trading volume might be reflecting differences of opinion among investors about the final value of a security. Ofek and Richardson (2003) and D'Avolio (2002) show that stocks with high borrowing fees, internet stocks and IPOs had high turnover rates during 1998-2000, while Lee and Swaminathan (2000) show that low volume stocks have characteristics associated with value stocks (including standard proxies for differences of opinion). Cochrane (2002) shows that during 1999 the positive correlation between value (market-to-book ratio) and turnover for NASDAQ stocks was extremely high compared to previous years. Mei, Scheinkman and Xiong (2004) show that speculative trading is a major determinant of the cross-sectional variation of the A-B share premia for the Chinese stock market during 1994-2004, after controlling for differences in liquidity. These empirical findings support an alternative explanation for the turnover effect - speculative trading - based on theoretical models that allow for differences of opinion among investors.

The speculative trading explanation is based on theoretical models that combine differences of opinion and short-sales constraints. Differences of opinion help to explain high levels of trading volume (Varian (1989), Harris and Raviv (1993) and Kandel and Pearson (1995)), and if short-sales are costly, there are implications for the equilibrium level of prices. Miller (1977) first pointed out that in this case prices will reflect a more optimistic valuation since pessimistic investors are kept out of the market. However, in a static setting, these assumptions cannot explain both high trading volume and high price

[6] Firm-level data on bid-ask spreads is only available annually and only for NYSE stocks. Measures of liquidity can be constructed using intraday data (Trade and Quote Database) from 1993-2002, but it requires data intensive methods. On the other hand, monthly data on trading volume is available from CRSP for 1962-2002.

levels. Scheinkman and Xiong (2003) and Hong, Scheinkman and Xiong (2005) formalize this argument in a dynamic setting in which overconfidence is the source of differences of opinion. Asset prices will then incorporate a speculative component, linking trading volume, overconfidence and asset returns. A higher level of differences of opinion implies a higher level of prices and a higher turnover rate and hence, turnover might be used as a proxy for differences of opinion and it should be linked to high levels of price and low expected future returns.

This paper is an effort to empirically evaluate the effects of turnover on returns, in particular to which extent this effect is due to liquidity reasons. We address the alternative explanation of speculative trading by investigating the relationship between turnover and cross-sectional returns for glamour stocks. For these purposes, we first construct proxies for illiquidity costs, including the bid-ask spread and measures of price impact of a trade as in Kyle (1985), using intraday data. We confirm previous findings on the poor performance of the bid-ask spread for the particular period covered in the sample, showing that the measures of price impact are able to capture liquidity variation across stocks. We test the effects of turnover on returns after controlling for the illiquidity measures, providing a test of the effects of trading activity not attributable to liquidity reasons. We consider a large sample of stocks listed on NYSE and NASDAQ from 1993 to 2002, performing cross-sectional regressions for the aggregate sample, across exchanges, across size groups and across book-to-market ratio groups. We address the speculative trading theory by analyzing the effects of turnover on cross-sectional returns for glamour stocks.

The analysis of the effects of speculative trading and illiquidity on cross-sectional returns is still an open area of research in the trading volume literature. A general test and a definite evaluation of these two components is somehow limited by the fact that the only observable variable is the actual trading activity level. First, liquidity is an unobservable variable and it cannot be directly measured. Moreover, limited data on firm-level illiquidity costs creates an additional problem in constructing illiquidity proxies. Hence, the illiquidity component of trading activity cannot be exactly identified. Second, measures of speculative trading depend on assumptions and parameterizations that also compromise general results.

We contribute to the existing literature by testing the effects of trading activity on returns after controlling for illiquidity costs and hence, providing a test that partially isolates the liquidity component of trading. We also provide evidence relating trading activity with a measure of overvaluation, investigating the speculative trading explanation. The …ndings of this paper might also motivate further theoretical research relating liquidity and di¤erences of opinion.

The results of the paper can be summarized as follows: we con…rm the existence of a strong and negative e¤ect of turnover on cross-sectional returns for NASDAQ and NYSE stocks. We observe that illiquidity is strongly related to …rm size while the impact of trading activity on returns is signi…cant even among the largest …rms. We show that trading volume is higher for glamour stocks and that the premium for holding a low volume stock is higher for glamour stocks, when compared to value stocks. Finally, average illiquidity costs are only signi…cant for the smallest …rms. We update the analysis of trading activity e¤ects to 2002, showing that there is a signi…cant change in the qualitative e¤ect of turnover on returns after 1998.

The rest of the paper is organized as follows. In section 2 we discuss related literature. In section 3 we present the testable hypotheses. In section 4 we describe the construction of the illiquidity variables. In section 5 we describe the asset pricing data and the main empirical results. Conclusions are presented in Section 6.

2 Related Literature

This paper relates to two branches of empirical literature in asset pricing. The …rst one investigates the e¤ects of illiquidity costs on cross-sectional returns using alternative proxies for this additional factor (bid-ask spreads, price impact of a trade, dollar volume and share turnover).[7] In particular, some of the studies use trading activity as a proxy for illiquidity costs. Datar et al. (1998) use share turnover rate as a measure of liquidity in cross-sectional regressions for NYSE stocks from 1962 to 1991, …nding strong evidence that turnover forecasts returns after controlling for size, book-to-market, …rm's beta and the January e¤ect. On average, a decrease of 1% in turnover increases the required rate of return by 4.5 basis points per month.

Similarly, Brennan et al. (1998) …nd strong evidence on the importance of trading activity in forecasting stock returns. Using dollar volume as a proxy for trading activity,

[7] There is also extensive literature on the time-series e¤ects of transaction costs. See, for example, Jones (2002).

they show that there is a significant and negative effect of volume on returns and that this effect is robust to the choice of risk-adjustment model. For a sample covering 1966-1995, a one standard deviation increase in dollar volume leads to a decrease in excess returns of 0.11% per month, after controlling for the usual non-risk factors. Moreover, they also find that there is a reversal in the size effect when dollar volume is included in the regression specification.

In Amihud and Mendelson (1986), cross-sectional returns are forecasted by bid-ask spreads for the U.S. stock market. They sort a sample of NYSE stocks from 1960 to 1981 into portfolios according to their bid-ask spreads, finding strong evidence that returns on higher-spread portfolios exceed returns on the low spread portfolios. In particular, a 1% increase in spread leads to a 0.211% increase in monthly returns. They also show that firm size and bid-ask spreads are strongly related, since size is no longer significant after the inclusion of the spread in the regression. Elswarapu and Reinganum (1993) find results that contradict Amihud and Mendelson (1986). Using the same measure of bid-ask spreads as the illiquidity measure for 1961-1990, they show that the positive association between bid-ask spread and returns appears to be seasonal, confined to the month of January.

Brennan and Subrahmanyam (1996) estimate the price impact of a trade using two specifications of a trade indicator model and intraday data for 1985 and 1988. They sort monthly stock returns into portfolios by the resulting estimated price impact and firm size for the years of 1984 to 1991. They find significant evidence that returns increase with these measures of illiquidity after controlling for the Fama-French factors. In particular, they find that the regression coefficients on the indicator variables for price impact groups increase monotonically from low (more liquid) to high (less liquid) portfolios, suggesting that excess returns are higher for less liquid stocks.

This paper also relates to the literature on differences of opinion, cross-sectional returns and trading activity. These studies test predictions of theoretical models that assume heterogeneous beliefs,[8] using alternative proxies for differences of opinion. When this assumption is combined with short-sales constraints, there are implications for the

[8] Models that include heterogeneous beliefs and explain high level of trading volume include Varian (1989), Harris and Raviv (1993) and Kandel and Pearson (1995). Scheinkman and Xiong (2004) survey the recent literature on heterogeneous beliefs models and the implications for trading volume and asset prices.

equilibrium price level and hence, for cross sectional returns, in line with the argument of Miller (1977). Mei, Scheinkman and Xiong (2004) test the implications of the theoretical models of Scheinkman and Xiong (2003) and Hong, Scheinkman and Xiong (2005), in which overcon…dence is the source of di¤erences of opinion. They investigate the role of speculative trading in explaining the A-B share premia that was observed in the Chinese stock market during 1993-2000.[9] They …nd that the turnover rates of A shares explain on average 20% of monthly cross-sectional variation of the A-B share premia for 1994-2004 after controlling for di¤erentials in liquidity, suggesting that speculative trading was a major determinant of the cross-sectional variation in returns.

Chen et al. (2002) show that breadth of mutual fund ownership is positively correlated with overvaluation proxies and that reductions in breadth lead to lower future returns. Adjusting for size, book-to-market and momentum, they …nd that stocks in the lowest decile of change in breadth in the prior quarter underperform stocks in top decile by 4.85% in a twelve month horizon. Diether et al. (2002) use dispersion in analysts' earnings forecasts as a proxy for di¤erences of opinion and report that stocks with higher dispersion predict signi…cantly lower returns. The portfolio of stocks in the highest quintile of dispersion underperforms a portfolio in the lowest quintile by 9.48% a year.

Lee and Swaminathan (2000) show that higher trading volume predicts lower future returns in long horizons, emphasizing that turnover is weakly related to liquidity proxies and that …rms with high past turnover ratios have characteristics associated with glamour …rms. This particular …nding is in line with the tests performed in this paper, since we also test the relationship between turnover and an overvaluation indicator but we explicitly control for liquidity.

Finally, we should mention two recent papers relating liquidity with measures of overcon…dence. Baker and Stein (2004) propose a model in which the price impact of a trade will be negatively correlated with the level of disagreement among investors. They assume short-sales constraints and underreaction of a group of non-rational traders to the information revealed by a transaction in a Kyle (1985) setting. The model is not rejected using aggregate market data on share turnover as a liquidity proxy and market

[9] As explained in Scheinkman and Xiong (2004), during that time period Chinese …rms o¤ered two classes of shares that, despite the same cash‡ows, have di¤erent level of prices: A-share prices were on average 400% higher than the corresponding B-shares.

returns. However, the predictions of this particular model concern the time-series e¤ects of liquidity on returns, while our paper studies the cross-sectional relationship. Sadka and Scherbina (2004) test the hypothesis that a higher level of divergence of opinion (proxied by analyst disagreement) increases market maker costs, by assuming that some investors are better informed in how to aggregate analysts' opinion. Therefore, a higher level of divergence of opinion should increase trading costs. They …nd evidence that cross-sectionally, less liquid stocks have a higher degree of mispricing, using a measure of illiquidity similar to the one calculated in this paper (price impact of a trade).

3 Testable Hypotheses

We investigate the e¤ects of trading activity on cross-sectional returns and in particular, to which extent trading activity re‡ects liquidity or speculative trading. Excessive trading volume is predicted by models that assume heterogeneous beliefs (e.g. Varian (1989), Harris and Raviv (1993) and Kandel and Pearson (1995)) since investors are willing to trade if their posterior beliefs about the value of a risky asset are di¤erent. When heterogeneous beliefs are combined with short-sales constraints, there are implications for the equilibrium level of prices (as pointed out by Miller (1977)), which will re‡ect a more optimistic valuation since pessimistic investors are kept out of the market.

We follow this literature and we empirically evaluate two predictions of the theoretical model in Hong, Scheinkman and Xiong (henceforth HSX)(2005) in which overcon…dence is the source of heterogeneous beliefs[10] and short-sales are costly. Predictions of this model are also presented in Section 2 of Mei, Scheinkman and Xiong (henceforth MSX) (2004) in an empirical application of the model for the Chinese stock market. This model is particularly appealing for our purposes since it leads to a broader range of predictions that include not only excessive trading volume but also higher price levels and e¤ects of speculative trading in cross-sectional returns.[11]

[10] As in Scheinkman and Xiong (2003).

[11] Overcon…dence, as a relevant bias in decision making, has been extensively studied in the psychological literature as well as in empirical behavioral …nance models. See, for example, Hirshleifer (2001) for a survey on the psychological …ndings and Glazer, Noth and Weber (2004) for recent empirical tests of the relationship between overcon…dence proxies and trading volume. Also, the assumption of short sales constraints is reasonable since, for example, institutional frictions forbid most mutual funds to take short positions (Almazan et al. (2003)).

We incorporate trading costs in this model in the standard way, i.e. we assume that trading costs are not a¤ected by overcon…dence[12] and therefore, trading costs a¤ect returns as in the traditional liquidity literature:[13] since trading is costly, investors will require a higher return rate for holding more illiquid stocks, as trading costs act as a tax on trading. Therefore, returns should increase with illiquidity costs cross-sectionally.

Since the scope of this paper is to study the e¤ects of trading volume on cross-sectional returns, we limit our analysis to Section 3 of HSX (2005) and we brie‡y describe the corresponding three-period version of the model.

Hong, Scheinkman and Xiong (2005) consider a three-period model[14] with one risky asset in …xed supply Q. There are two groups of investors with mean-variance preferences and the same prior beliefs about the fundamental value of the risky asset at $t = 0$. At $t = 1$, both groups receive two public signals. Thus, all investors have the same set of available information at $t = 1$. Investors are overcon…dent and overestimate the informativeness of a di¤erent signal, i.e. each group of investors place di¤erent weights in the two signals, resulting in di¤erent updated beliefs of the fundamental value at $t = 1$.

Therefore, even though investors have the same prior beliefs and receive the same public signals, heterogeneous beliefs arise from overcon…dence of the two groups of investors. Moreover, with short-sales constraints, the group that is more pessimistic sits out of the market and for a certain range of divergence of opinion,[15] prices at $t = 0$ and at $t = 1$ will include an additional positive term re‡ecting the possibility of reselling shares at $t = 1$, when the other group of investors has more optimistic beliefs. As a result, asset prices incorporate a speculative component (resale option) that connects trading volume, overcon…dence and returns in the model: investors pay prices that exceed their own valuation of future payo¤s, anticipating pro…ts from reselling in the future to more optimistic investors.

We are particularly interested in the theoretical prediction relating turnover rates and expected returns. HSX (2005) show that the expected turnover rate from $t = 0$ to $t = 1$

[12] Odean (1998) analyzes the case in which overcon…dence a¤ects market liquidity in alternative market structure settings.

[13] As in Amihud and Mendelson (1986), Proposition 2 and the following literature.

[14] In the following sections of the paper they consider a discrete time, multi-period model.

[15] More speci…cally, if the di¤erence in the updated beliefs among the two groups is bigger than the ratio of asset ‡oat to the (optimistic group) risk-bearing capacity.

increases with the degree of overcon…dence since when agents are more overcon…dent, there is more dispersion of beliefs and hence, more trading (HSX (2005), Proposition 3, p.13 and MSX (2004), Proposition 1, p. 7). This result also follows from a model that assumes exogenous heterogeneous beliefs (as di¤erent prior beliefs or di¤erent likelihood functions) but HSX (2005) provide a richer setting since …rst, heterogeneous beliefs are not assumed ex ante and second, because a speculative component is incorporated in the level of prices.

Hence, if two assets have di¤erent levels of speculative component, it can be shown that the expected return on the more overvalued asset decreases with the overcon…dence parameter. Moreover, since turnover increases with overcon…dence, a stock with higher turnover rate has lower expected future returns (SMX (2004), p. 14-15).

Our testable hypotheses are summarized as follows:

Hypothesis 1: Expected cross-sectional returns decrease with turnover, after controlling for illiquidity costs.

Hypothesis 2: Higher levels of turnover are associated with more overvalued stocks.

In order to test these hypotheses, we …rst test the e¤ect of lagged turnover rates in cross-sectional returns for a large (and unsorted) sample of stocks. Next, we test to which extent this e¤ect changes when we control for illiquidity costs and when we control for …rm size. This …rst set of tests measures the e¤ects of turnover for the average traded stock and the interaction between turnover, …rm size and illiquidity costs in cross-sectional returns. In the second set of tests, we address the relationship between an overvaluation measure and turnover (Hypothesis 2) more closely, by investigating turnover level, turnover variation and its e¤ects on returns for glamour stocks.

4 Measures of Illiquidity Costs

4.1 Data and Methodology

We consider …ve alternative measures of illiquidity costs, retained or estimated using transaction data from the Trade and Quote (TAQ) database from January 1993 to December 2002. We …rst select all NYSE and NASDAQ-listed stocks present on both CRSP monthly database and on TAQ database in a particular year. We restrict the analysis to common stocks of …rms incorporated in the United States (CRSP share type codes of 10 or 11), matching the firms by their respective CUSIPs in the two different databases. We discard a stock for a given month if its end-of-the-month closing price is greater than $999. The following variables are retained from the Trades Database: transaction price P (in dollars) and transaction size q (in number of traded shares). Following Lee and Ready (1991), each transaction is matched with the last posted quote that existed at least five seconds prior to the transaction time.[16]

For each matched transaction, we compute two measures of trade execution costs from the Quotes Database: the proportional quoted spread ($PQSPR$), defined as the quoted bid-ask spread (ask-price minus bid-price) divided by the mid-quote P^M (bid-ask midpoint) and the proportional effective spread ($PESPR$), defined as two times the absolute value of the difference between the transaction price P and the mid-quote P^M, divided by the transaction price P.

We follow some of the data filtering used in Chordia, Roll and Subrahmanyam (2000, 2001):[17] transactions with negative price are ignored; quotes with negative quoted spreads ($QSPR$) are ignored. We delete a transaction if: $QSPR >$ \$5; $(ESPR/QSPR) >$ 4.0; $(PESPR/PQSPR) >$ 4.0; $(QSPR/P) >$ 0.4. We delete a stock in a month when its average transaction price $P <$ \$2.[18] Finally, in order to guarantee robustness of the monthly estimates, if there are less than 60 trades on a stock in a given month, we discard the stock.[19] For each stock i, the two illiquidity measures are first averaged across all transactions that satisfy the filtering described above in a given day. Monthly averages are then calculated for each stock i, denoted respectively, as $PQSPR_{(i,t)}$ and $PESPR_{(i,t)}$.

Even though the bid-ask spread is considered a standard proxy for illiquidity costs, we do not consider it an optimal choice for the illiquidity factor in asset pricing regressions for the particular period covered in our sample. First, many large trades occur outside the spread, and small trades may occur within the quoted spread. Second, the cross-sectional variation of the quoted spread might be understated, especially before regulation changes in 1997, when NASDAQ quotes did not appear to vary too much

[16] For NYSE-listed stocks, best-bid-offer (BBO) quotes are not calculated. Instead, we consider only NYSE quotes as a proxy for BBOs.

[17] We consider all transactions between 9:30a.m. and 4p.m. For NYSE-listed stocks, the first transaction after the opening time is ignored.

[18] As in Chordia, Roll and Subrahmanyam (2000), this is a way of minimizing the effects of tick size.

[19] See details on the filtering of transactions and included stocks in the Appendix.

across stocks.

More importantly, recent empirical literature shows that the use of the quoted spread as a liquidity proxy on cross-sectional asset pricing tests in fact contradicts the liquidity theory predictions: the sign of the bid-ask spread is found to be negative and significant, which cannot be explained by liquidity reasons. For a sample of NYSE stocks during 1984-1998, Easley et al. (2002) find that the sign of the proportional quoted spread in monthly cross-sectional regressions is negative and significant after controlling for firm size, book-to-market, firm's beta and their proxy of information-based trading.[20] Brennan and Subrahmanyan (1996), using a sample of NYSE stocks from 1984-1991, also find a negative and significant sign on the quoted spread in GLS regressions after controlling for the Fama-French factors.[21] Finally, Eleswarapu and Reiganum (1993) find that the effect of bid-ask spreads on cross-sectional returns is not significantly different from zero in non-January months using a sample of NYSE stocks for 1961-1990 and controlling for firm's beta and size.

In order to deal with these potential problems, and in particular with the poor performance of the spread in recent empirical studies, we construct an alternative measure of illiquidity costs, based on a theoretical model of trading costs. This measure must be empirically positively related to the bid-ask spread but with a higher cross-sectional variability, reflecting the actual liquidity differences that are taken into account by investors when choosing a portfolio. Moreover, the liquidity measure must have a positive sign in cross-sectional asset pricing regressions, in line with the main prediction of the liquidity-based theory. We choose a measure based on theoretical models of asymmetric information that fulfill all these requirements, as shown in the remainder of this section.

Theoretical models that incorporate asymmetric information (Kyle (1985), Glosten and Milgrom (1985), Easley and O'Hara (1987)) suggest that there is an important component of illiquidity costs due to the adverse selection problem caused by the presence of privately informed traders in financial markets. Since this adverse selection component

[20] They measure proportional quoted spread as the average daily opening percentage spread in the previous year, finding a coefficient of -0.051 and a t-statistic of -2.27 in weighted least squares regressions (Table VIII, p. 2216).

[21] They calculate proportional quoted spread by averaging it across all quotations during the reference years of 1984 and 1988. The coefficient on the proportional quoted spread is -0.93 with a t-statistic of -6.00 in GLS regressions after controlling for the Fama-French factors (Table 5, Panels A and B, pp. 457-458).

is better captured by measures of the price impact of a trade, we estimate illiquidity costs using three alternative specifications of a trade indicator model for the price impact of a transaction. In particular, we estimate three versions of the Glosten and Harris (1988) model ignoring discreteness.[22]

In Glosten and Harris (1988) and in the related microstructure literature, trading costs due to adverse selection are considered permanent costs since they affect the market makers' beliefs about the final value of the security. We also allow for transitory costs of trading which affect only the level of prices, reflecting order processing costs and market makers' profits.[23] Following Glosten and Harris (1988), we assume a linear specification on trade size for both the permanent and the transitory costs of trading. Parameters λ_2 and λ_1 represent respectively, the fixed and the variable components of the permanent costs of trading while parameters φ_1 and φ_2 represent the fixed and the variable components of the transitory costs of trading.[24]

We define D_k as the buy-sell trade indicator variable, as in Lee and Ready (1991): a transaction k is considered a buyer-initiated transaction (seller-initiated transaction) if $P_k > P_k^M$ ($P_k < P_k^M$) and it is assigned as $D_k = +1$ ($D_k = -1$). If the transaction occurs at the mid-quote we assign $D_k = 0$. Let q_k be the trade size of transaction k and P_k the transaction price. The price change from transaction $k-1$ to transaction k reflects the one-way transaction costs faced by investors and it is given by:[25]

$$\Delta P_k = \lambda_1 D_k q_k + \lambda_2 D_k + \varphi_1 (D_k - D_{k-1}) + \varphi_2 (D_k q_k - D_{k-1} q_{k-1}) + e_k \qquad (1)$$

We include a model that results in (1) in the Appendix, following Glosten and Harris (1988). Assumptions about the structure of the permanent and the transitory costs imply alternative versions of equation (1).

We estimate three versions of (1) using OLS for each firm separately, for each month t. We first consider the particular specification tested in Glosten and Harris (1988) and in Brennan and Subrahmanyam (1996), assuming $\lambda_2 = \varphi_2 = 0$ in Equation (1). This

[22] Equation (2) in Glosten & Harris (1988), p. 128.

[23] We do not consider inventory holding costs in specification (1). As pointed out by Glosten and Harris (1988), these costs are small in intraday frequency.

[24] We include the full specification of the model of trading costs, following Glosten and Harris (1988), in the Appendix.

[25] Equation (1) gives the one-way costs of trading and it is comparable to a measure of half-spread.

version assumes that the adverse selection component of illiquidity costs is proportional to trade size, i.e. information is released through the size of a particular trade. Meanwhile, the order processing cost per trade is assumed to be constant. Defining $\overline{q}(i,t)$ as the monthly average trade size for stock i in month t, $\overline{P}(i,t)$ as the monthly average transaction price for stock i in month t,[26] and $\hat{\lambda}_1(i,t)$ and $\hat{\varphi}_1(i,t)$ as the OLS estimates of the corresponding parameters for stock i in month t, the corresponding (round-trip) illiquidity cost is then defined as:

$$ILLIQ(1)_{(i,t)} := 2 \cdot \left[\frac{\hat{\lambda}_1(i,t) \cdot \overline{q}(i,t) + \hat{\varphi}_1(i,t)}{\overline{P}(i,t)} \right] \tag{2}$$

Next, we test the model in which the only explanatory variable for intraday price changes is the indicator variable, that is equation (1) assuming $\lambda_1 = \varphi_2 = 0$. In this specification, the fact that there is a seller or a buyer in the market is sufficient to release private information, i.e. the adverse selection component of trading costs is independent of trade size. The corresponding (round-trip) illiquidity cost is defined as:

$$ILLIQ(2)_{(i,t)} := 2 \cdot \left[\frac{\hat{\lambda}_2(i,t) + \hat{\varphi}_1(i,t)}{\overline{P}(i,t)} \right] \tag{3}$$

Finally, we test the unrestricted version of (1), estimating all four parameters. The corresponding illiquidity cost is defined as:[27]

$$ILLIQ(3)_{(i,t)} := 2 \cdot \left[\frac{\hat{\lambda}_1(i,t) \cdot \overline{q}(i,t) + \hat{\lambda}_2(i,t) + \hat{\varphi}_1(i,t) + \hat{\varphi}_2(i,t) \cdot \overline{q}(i,t)}{\overline{P}(i,t)} \right] \tag{4}$$

Summary statistics for the spread measures and for the measures of illiquidity costs[28] are reported in Panel A of Tables 2 and 3.[29] Table 2 refers to NYSE-listed stocks and

[26] We divide by the price in order to have a proportional measure, comparable to the proportional quoted spread.

[27] We do not impose restrictions on parameter values in the estimation, but we set illiquidity costs equal to zero if the corresponding estimate is negative (around 5%-6% of the sample for NYSE stocks and around 8% of the sample for Nasdaq stocks).

[28] In the remainder of this paper, we refer to measures ILLIQ(1), ILLIQ(2) and ILLIQ(3) as measures of "illiquidity costs".

[29] We also report summary statistics on average price and average transaction size in Panel A of Tables 2 and 3.

Table 3 to NASDAQ-listed stocks. We observe that the illiquidity costs measures are able to capture the level of trading costs reflected by the spreads but with a higher variability across stocks, resulting in a better approximation of the differences in trading costs considered by investors when selecting a portfolio.

The average levels of $ILLIQ$(1), $ILLIQ$(2) and $ILLIQ$(3) are between the average levels of the proportional quoted spread and the proportional effective spread, meaning that the level of illiquidity costs is on average very close to the level of the standard proxy: for NYSE (NASDAQ) average illiquidity costs are between 0.72% (2.74%) and 0.81% (2.84%) while the average proportional quoted spread is 0.93% (3.08%). More importantly, the variability of illiquidity costs is higher than the variability of the spread, showing that in fact the variation in illiquidity is underestimated by the proportional quoted spread, which may be the reason for its poor performance in asset pricing tests. For NYSE (NASDAQ) stocks, the average standard deviation of the illiquidity measures is between 2.15% (4.35%) and 2.31% (4.48%) while the standard deviation of the proportional quoted spread is 0.84% (2.29%) on average, i.e. the cross-sectional variation of illiquidity costs is around two times the bid-ask spread variation.

We also observe other important points from the summary statistics. First, the average levels of the three measures of illiquidity costs are very similar, with the first measure ($ILLIQ$(1), as in Glosten and Harris (1988) and Brennan and Subrahmanyam (1996)) smaller for both exchanges. We also notice that for both exchanges the proportional quoted spread is higher than the proportional effective spread, reflecting within-quote trading (as in Chordia, Roll and Subrahmanyam (2001)). Finally, as expected, all measures of spread and illiquidity costs are considerably higher for NASDAQ-listed stocks, as documented in previous literature (Bessembinder and Kaufman (1997), Huang and Stoll (1996)):[30] the average proportional quoted spread and the illiquidity costs are approximately three times higher in NASDAQ than in NYSE.

In Panel B of Tables 2 and 3 we report time-series averages of cross-sectional correlations between the illiquidity costs and the spread measures for NYSE-listed and NASDAQ-listed stocks, respectively. We show that the three measures of illiquidity costs are positively correlated with both measures of proportional spread,[31] indicating

[30] For a sample of matched large capitalization NYSE and Nasdaq stocks during 1991, Huang and Stoll (1996) find that average execution costs on NASDAQ exceed those for NYSE by a factor of two to three times.

[31] In Brennan and Subrahmanyam (1996), the corresponding measure of permanent illiquidity costs has

that the illiquidity measures used in this paper are valid proxies for the standard measure of trading costs.

We also notice that for both exchanges, the two spread measures are highly correlated and the three measures of illiquidity costs are highly correlated within each other. In particular, $ILLIQ$(2) and $ILLIQ$(3) are highly correlated - with a correlation coe¢ cient of around 0.98 for both exchanges - suggesting that both speci…cations are observationally equivalent in this particular sample. Since $ILLIQ$(3) is the general case of equation (1), we consider only $ILLIQ$(1) and $ILLIQ$(2) in the asset pricing tests. This will reduce potential problems related to errors in explanatory variables, since we reduce the number of parameters by half by choosing $ILLIQ$(2).

4.2 Illiquidity costs over time and across exchanges

In this subsection we present the evolution of all measures of illiquidity costs and spreads over time, showing that our illiquidity measures respond to regulation changes during 1993-2002 and that the gap between illiquidity costs and spreads in NASDAQ and NYSE has narrowed over time. Figures 1-3 plot the evolution of the (equally-weighted) cross-sectional means of illiquidity costs and spread measures over the entire sample period.

Figure 1 shows a steady and slow decrease in both measures of the spread for NYSE-listed stocks, from January 1993 to June 1997, when we observe an abrupt decline possibly due to the reduction of the minimum tick size on NYSE (as in Chordia, Roll and Subramanyam (2001)). The spread (especially the quoted spread) seems to increases during 1999, even though there were no signi…cant changes in regulation until 2000. By the second half of 2000 it drops again, responding to the reduction in tick size (decimalization) gradually implemented from 08/2000 to 01/2001.

For NASDAQ-listed stocks, both measures of spread show an overall decline from 1993 to 2002 (Figure 2). In particular, there is an abrupt drop in the …rst-half of 1997 due to the implementation of new order handling rules and to the reduction of the minimum tick size (as in Barclay et al. (1999) and Bessembinder (1999)). In our sample, we do not observe the drop in NASDAQ trading costs immediately after 05/1994, reported by Christie and Schultz (1994).[32] The estimated measures of illiquidity costs are less

a 0.38 correlation with the proportional quoted spread and the transitory component has a correlation of 0.78.

[32] Bessembinder and Kaufman (1997) do not …nd this drop either.

smooth over time but they follow the same trends observed for the spread. In Figure 3, we plot illiquidity costs measures for both exchanges, showing that the gap between illiquidity in NASDAQ and NYSE has considerably narrowed since 1993 (as in Barclay et al. (1999)).

In Figure 4, we decompose NYSE illiquidity costs ($ILLIQ(2)$) into the two components (price impact and market maker's profits). We observe that the price impact component is smoother over time when compared to the transitory component and the latter closely responds to the regulation changes described above. This result is expected from the assumptions of the model: the effects of regulation changes should have a much higher impact on the transitory component and the costs related to adverse selection (price impact) are harder to address through regulation.

5 Asset Pricing Tests

5.1 Data and Methodology

We use the CRSP monthly database to obtain data on returns, trading volume and firm characteristics for the period of January 1993 to December 2002. $RET(t)$ is the raw return at month t. For each month, share turnover is calculated as the number of shares traded divided by shares outstanding. $TURNOVER(t-1)$ is defined as the average of share turnover for the three previous months, $t-1$, $t-2$ and $t-3$. We also define a demeaned measure of turnover, allowing for two means each month: one for NYSE firms and one for NASDAQ. The exchange-adjusted turnover variable is denoted $XTURNOVER(t-1)$. $SIZE(t-1)$ is the logarithm of market capitalization (price times shares outstanding, in US$ thousands) at the end of month $t-1$. We construct book-to-market ratios ($BK/MKT(t-1)$) following previous literature (Cohen, Polk, and Vuolteenaho (2003)), using the COMPUSTAT annual database: book equity (BK) is stockholders' equity[33] plus deferred taxes and investment tax credit plus post-retirement benefit liabilities minus the book value of preferred stock.[34] For each month in year l, we use the corresponding BK/MKT calculated for year $l-1$, deleting the firms

[33] Using COMPUSTAT data, stockholders' equity is calculated as the book value of common equity (data item 60) plus the par value of preferred stock. If data item 60 is not available, we use the book value of assets (data item 6) minus total liabilities (data item 181).

[34] From COMPUSTAT data, the book value of preferred stock is (in order of availability) redemption (data item 56), liquidation (data item 10) or par value (data item 30).

with negative book-to-market from the sample. From CRSP monthly database, we calculate each firm's six month cumulative holding-period return to the end of month $t-1$, denoted as $MOM6(t-1)$. Finally, we use two alternative monthly measures of illiquidity costs, estimated using all transactions in the previous month: $ILLIQ(1)_{(t-1)}$ and $ILLIQ(2)_{(t-1)}$. We match the firms of CRSP/COMPUSTAT with firms on TAQ by their respective CUSIPs. The final sample has an average of 3,197 stocks per month: 1,179 NYSE-listed stocks and 2,018 NASDAQ-listed stocks.

Tables 1 to 3 show summary statistics and contemporaneous correlations for the variables in the asset pricing regressions. Table 1 refers to all firms in the sample, Table 2 refers to NYSE-listed stocks and Table 3 to NASDAQ-listed stocks. In Panel A, we observe that the levels and variability of turnover, illiquidity costs and bid-ask spread are considerably higher for NASDAQ stocks, indicating that we should use exchange-specific measures of turnover and we should also include a separate analysis for each exchange in asset pricing tests. On average, the NASDAQ firms included in the sample are smaller firms, with a lower book-to-market ratio, a higher turnover rate - almost two times the turnover rate in NYSE - and higher illiquidity costs (as shown in Section 4.1).

We investigate the relationship between the explanatory variables for all firms and for each exchange in Panel B of Tables 1 to 3, in particular the correlation of turnover with measures of trading costs and book-to-market. The most important observation is that the degree of correlation with the illiquidity measures is not particularly high, suggesting that turnover is not an accurate proxy for liquidity:[35] for all firms, the correlation between xturnover and illiquidity costs is between -0.113 and -0.121 depending on the illiquidity measure; the correlation with spread measures is between -0.239 and -0.228[36] and the correlation with firm size is 0.143. Moreover, the negative correlation between book-to-market and turnover, especially for NASDAQ stocks (-0.149), suggests that there is more trading in the most overvalued firms in line with Hypothesis 2. Turnover is also positively correlated with momentum, as in Lee and Swaminathan (2000).

Next, we perform cross-sectional regressions following the weighted least-squares

[35] As pointed out by Lee and Swaminathan (2000), turnover is a scaled measure of trading volume and therefore, there is no clear intuition to justify its use as a liquidity proxy.

[36] A low degree of correlation between turnover and liquidity proxies is also reported by Lee and Swaminathan (2000) for NYSE firms between 1964 and 1995: the correlation coefficient between yearly relative spread and turnover is -0.12.

(WLS) methodology in Litzenberg and Ramaswany (1979).[37] We denote N_t as the total number of firms at month t, R_i^t as the raw return on security i in month t, and x_{ik}^{t-1} as the lagged firm i characteristics (where k = share turnover, firm size, book-to-market ratio, momentum and illiquidity costs), as defined in this section. We estimate the following regression model at each month $t = 1, 2, .., 119$:

$$R_i^t = \gamma_0^t + \sum_{k=1}^{K} \gamma_k^t x_{ik}^{t-1} + \varepsilon_i^t \qquad i = 1, 2, .., N_t \tag{5}$$

We denote by $\widehat{\gamma}_{kt}$ the estimated coefficient for each month t. Since we are interested in the cross-sectional effects of each characteristic, we follow Litzenberger and Ramaswamy (1979) when averaging the coefficients across time. Thus, the pooled WLS estimator $\widehat{\gamma}_k$ is a weighted average of the monthly coefficients. The weights are inversely proportional to the variances of the coefficients, adjusted for heteroskedasticity:

$$\widehat{\gamma}_k = \sum_{t=1}^{T} Z_{kt} \widehat{\gamma}_{kt} \text{ and } Z_{kt} = \frac{[Var(\widehat{\gamma}_{kt})]^{-1}}{\sum_{t=1}^{T} [Var(\widehat{\gamma}_{kt})]^{-1}} \tag{6}$$

$$Var(\widehat{\gamma}_k) = \sum_{t=1}^{T} Z_{kt}^2 Var(\widehat{\gamma}_{kt}) \tag{7}$$

5.2 Results

In this section, we present the empirical results of the asset pricing tests, investigating the effects lagged turnover rates on cross-sectional returns after controlling for illiquidity costs. In subsection A, we address Hypothesis 1 by discussing the regression results for the entire (unsorted) sample. We first analyze the effects of turnover on cross-sectional returns after controlling for $ILLIQ(1)$ and $ILLIQ(2)$. Next, we confirm prior results about the poor performance of the quoted bid-ask spread on asset pricing tests. We then perform the same analyses for each exchange separately. In subsection B, we perform the same set of regressions, grouping stocks by firm size quintiles, in order to analyze the relationship between firm size, illiquidity costs and turnover, in particular the magnitude

[37] This is an adjustment for the Fama-Mcbeth (1973) methodology. As explained in Campbell, Lo and MacKinlay ((1997), p. 216), this approach corrects for the errors-in-variables bias in the t-statistics and it is particularly important for firm-level regressions.

of the low-volume premium across size groups. In subsection C, we group stocks by book-to-market ratios, addressing Hypothesis 2 more closely. We first discuss the relationship between this particular overvaluation measure, turnover rates and illiquidity costs. We then analyze the regression results for each book-to-market group. Finally in subsection D, we present some empirical evidence on the behavior of turnover and its effect on cross-sectional returns during 1998-2002.

A. Aggregate Results

The regression results for the entire (unsorted) sample are summarized in Table 4A. In each month, we run a cross-sectional regression of stock returns on alternative combinations of factors (equation (5)), considering all stocks in the sample. Since trading volume is measured differently on NYSE and NASDAQ,[38] we include a separate measure of turnover for each exchange, denoted as NYTURN and NDQTURN.[39] We collect the 119 monthly estimates of the slope coefficients ($\hat{\gamma}_{kt}$) and the corresponding standard errors adjusted for heteroskedasticity $(Var(\hat{\gamma}_{kt}))^{\frac{1}{2}}$, for each explanatory variable. We aggregate the slope coefficients across time as in (6) – (7).

We find that the turnover rate is significantly negatively related to stock returns after controlling for size, book-to-market, momentum and illiquidity costs. In particular, the turnover coefficient remains strongly significant and negative after controlling for both measures of illiquidity. The magnitude of the turnover coefficient for NYSE (NASDAQ) stocks decreases, in absolute value, by 0.0016 (0.0006) when we include illiquidity costs in the regression.

This implies that across stocks, without controlling for illiquidity, a drop of 1% in the NYSE (NASDAQ) turnover rate increases the stock return by 5.04 (3.97) basis points per month. If we include illiquidity costs ($ILLIQ(2)$), the required increase on returns is 4.88 (3.91) basis points. In terms of comparable magnitudes, a one standard deviation difference in turnover rates across stocks listed in NYSE (NASDAQ) translates into a difference of 0.354% (0.750%) in expected monthly returns. If we control for illiquidity costs ($ILLIQ(2)$), this difference decreases slightly to 0.343% (0.74%). Therefore, the

[38] NASDAQ volume, due to the inclusion of inter-dealer trading, can be considered overstated relative to NYSE volume.

[39] We also perform the same regression using XTURNOVER(t). The results are very similar to results in Table 4.

effect of trading activity remains highly significant even after controlling for illiquidity costs, in line with Hypothesis 1.

We also find that the coefficient on illiquidity costs is significant and positively related to stock returns, which is consistent with the liquidity-based theory.[40] The magnitude of the effect varies from 0.063% to 0.08%, showing that illiquidity - when measured by estimates of transitory and permanent trading costs - is priced. However, this result does not hold when the proportional quoted spread is used as the illiquidity proxy, confirming prior empirical findings. The coefficient on the proportional quoted spread is not significantly different from zero for the sample period covered in this paper. In fact, if we consider each exchange separately, the sign of the spread coefficient contradicts the liquidity-based theory, as shown in the following paragraphs. We also find that for the entire sample, the size effect is related to illiquidity costs and it becomes statistically insignificant after controlling for illiquidity ($ILLIQ$(2)). We will address this point in the next subsection.

Next, we perform the same set of regressions across exchanges in order to analyze potential changes in the illiquidity effect due to alternative trading mechanisms. The results for NYSE-listed stocks are reported in Table 4B and the results for NASDAQ-listed stocks are reported in Table 4C. For both exchanges, the turnover coefficient is statistically significant and negative after controlling for illiquidity, as in Table 4A. The impact of a one standard deviation increase in turnover decreases average monthly returns by .338% (.731%) for NYSE (NASDAQ) listed stocks. For NASDAQ stocks, the economic significance of turnover decreases to 0.722% when illiquidity is included.

The coefficient on illiquidity costs is also positive and significant for NASDAQ stocks, in line with the liquidity explanation, while the bid-ask spread enters with a negative sign in the regression. We also notice that for NASDAQ-stocks, the size effect remains negative and significant after controlling for illiquidity - the inclusion of illiquidity decreases its economic significance by 20%. Therefore, there might be a size component captured by the illiquidity variable in NASDAQ stocks but we cannot identify it in the aggregate analysis. For NYSE stocks, we first confirm the poor performance of the bid-

[40] We also perform the same regression excluding turnover. The results are consistent with the liquidity theory: the coefficients on $ILLIQ$(1) and $ILLIQ$(2) are positive and significant while the coefficient on the bid-ask spread is negative and significant for NYSE-listed stocks and negative but not significant for Nasdaq stocks.

ask spread: the coe¢cient is strongly negative and signi…cant. The coe¢cients on both measures of illiquidity costs are positive, but only $ILLIQ(1)$ appears to be signi…cant. However, the inclusion of illiquidity costs actually increases the magnitude of trading activity e¤ects. This particular result might suggest that for our sample of NYSE stocks, illiquidity costs variation across stocks is small (as in Table 2) and hence, cross-sectional variation in returns does not respond to this variable. This is consistent with the fact that size is also not signi…cant for NYSE stocks.

The coe¢cients on the remaining characteristics are in line with previous …ndings.[41] We also notice that book-to-market is only signi…cantly positive for NASDAQ stocks, con…rming previous evidence that the value-growth premium is observed mostly for NASDAQ stocks.

B. Results across size groups

The aggregate results provide evidence that on average, turnover explains cross-sectional variation in expected returns after controlling for illiquidity costs, which is in line with Hypothesis 1. Since measures of illiquidity costs are related to …rm size[42] and the interaction between size and illiquidity varies across exchanges (but are not identi…able from the previous analyses), we present results across …rm size quintiles in this subsection. We attempt to investigate the relationship between trading activity, illiquidity and …rm size. In particular, we are interested in the e¤ects of turnover for large cap …rms. The liquidity explanation is less convincing for large cap …rms and hence, if turnover is proxying only for liquidity, we should not observe a signi…cant premium for less traded stocks among the largest …rms.

We …rst group all stocks into size quintiles for each month, according to NYSE breakpoints. We report summary statistics in Table 5A. Since NASDAQ …rms are on average smaller …rms (Table 3), the …rst size quintile (smallest …rms) includes a larger

[41] Easley et al. (2002) report a positive and signi…cant size coe¢cient and a non-signi…cant book-to market coe¢cient for NYSE stocks from 1985-1998. Datar et al. (1998) report a turnover coe¢cient of -0.05 for 1977-1991. Chordia et al. (2001) report a negative and non-signi…cant coe¢cient for size and a negative turnover coe¢cient of -0.00183 for a sample including NYSE and AMEX-listed stocks from 1966-1995.

[42] Brennan et al. (1998) …nd that the introduction of trading volume changes the sign of the size coe¢cient. Amihud and Mendelson (1986) …nd that the e¤ect of bid-ask spread on returns decreases after controlling for …rm size.

number of NASDAQ …rms, accounting for approximately half of the entire sample (1,578 …rms on average). Therefore, the highest quintile (largest …rms) includes mainly highly liquid and highly traded …rms: the average level of illiquidity costs is about …fteen times higher for the smallest …rms when compared to quintile 5, while NASDAQ turnover is three times higher in the highest quintile. Another important observation is that the largest …rms have higher book-to-market ratios (as in Table 1-3, Panel B), i.e. the largest …rms in our sample include a high percentage of glamour …rms. We present the same analysis separately for NASDAQ stocks, using NASDAQ breakpoints in order to check the robustness of the results to trading mechanisms. We report summary statistics on Table 5B.

We perform the same set of regressions (5) ¡ (7) for each size quintile.[43] The results for all stocks and NASDAQ stocks are reported, respectively, in Table 6A and Table 6B. We limit the analysis to the magnitude and signi…cance of the turnover and the illiquidity slope coe¢cients across size groups. We calculate the expected required premium for holding a share of low volume stocks in each group in order to have a measure of the magnitude of the turnover e¤ect.[44]

We show that turnover is signi…cantly negative for all size quintiles and even though the turnover coe¢cient decreases monotonically across size quintiles, we observe a substantial low-high volume premium even for the largest …rms: for all stocks (Table 6A), this premium is 0.46% per month. This result is di¢cult to reconcile with a liquidity explanation since the illiquidity e¤ect seems to be restricted to the smallest …rms: the sign on the illiquidity costs coe¢cient is only positive and signi…cant for the smallest …rms (quintile 1).[45] We also notice the poor performance of the quoted spread in capturing illiquidity, since it enters the regression with a signi…cant and negative sign even for the smallest stocks.

[43] We do not report the regression results for $ILLIQ(1)$, since $ILLIQ(2)$ seems to be a more accurate proxy for illiquidity costs in this particular sample (see Tables 1-3).

[44] The required premium for holding a share of the less traded stock (third row of table 6, denoted as Low-High Volume Premium) is calculated as follows: we multiply the turnover coe¢cient for each size quintile by the di¤erence between the 10th percentile of turnover (or xturnover) and the 90th percentile of turnover (or xturnover) for the corresponding group.

[45] A negative and signi…cant sign for the illiquidity variable is not consistent with the liquidity-based theory. We think that these results arise in the regressions by groups because illiquidity does not have enough variability, except for group 1 and hence, it might be proxying for risk variables related to the price level, that are omitted from the model.

Therefore, we have further evidence in favor of Hypothesis 1 and more importantly, we have evidence that the e¤ects of turnover on cross-sectional returns are caused by an alternative explanation to the liquidity hypothesis: if trading activity only impacts returns through liquidity reasons, the e¤ect of turnover on returns for large cap …rms should be negligible. Intuitively, there is no reason to require a liquidity premium for holding a highly liquid stock that can be sold at any time with very low trading costs. Hence, the e¤ects of trading activity, particularly for the largest …rms, must be explained by an alternative to the liquidity-based theory. We address a possible alternative explanation for this empirical result in the next subsection, when we investigate the relationship between turnover and a proxy for overvaluation.

C. Results across book-to-market groups

In this subsection we analyze the relationship between an overaluation proxy, trading activity and expected returns, addressing Hypothesis 2 more closely. We use book-to-market (BK/MKT) ratio as the overvaluation measure: a low BK/MKT indicates that the price is high relative to the fundamentals (Fama and French (1998), Laknonishof et al. (1994), Ponti¤ and Schall (1998)). We address Hypothesis 2 by …rst grouping all stocks into BK/MKT quintiles, according to NYSE breakpoints and NASDAQ-only stocks according to NASDAQ BK/MKT breakpoints. In particular, we are interested in the di¤erences between turnover and illiquidity for the lowest (glamour) and highest (value) quintiles.

Tables 7A and 7B report summary statistics for each BK/MKT quintile, considering respectively all stocks or only NASDAQ stocks. According to Hypothesis 2, turnover rates are higher among more overvalued stocks. We show that glamour stocks have higher turnover rates, especially for NASDAQ stocks (two times the turnover of value stocks). Moreover, the di¤erences in illiquidity costs are not particularly strong as observed among size groups, when illiquidity is about …fteen times higher for the smallest …rms when compared to the largest …rms. For NASDAQ stocks, turnover increases from 10% to 23% from the highest (value) to the lowest (glamour) BK/MKT quintile, while illiquidity decreases by less than 50% and it is still considerably high for glamour stocks: for example, ILLIQ(2) is 2.38% (1.80%) for NASDAQ (all stocks), suggesting that the higher observed level of turnover for glamour stocks is not explained by liquidity di¤erences. Hence, using BK/MKT as a proxy for overvaluation we have evidence supporting Hypothesis 2, in line with prior related …ndings. Cochrane (2002) …nds a positive and high cross-sectional correlation between turnover and market-to-book during the NASDAQ bubble for the aggregate market. Lee and Swmanaithan (2000) show that high volume stocks have characteristics associated with glamour …rms. Our results are in line with these previous …ndings but we explicitly control for illiquidity costs.

Next, we investigate if the e¤ect of turnover on returns is stronger for glamour stocks, by performing the same set of regressions (5) ¡ (7) for each BK/MKT quintile. The results for all stocks and NASDAQ stocks are reported respectively, in Table 8A and Table 8B. We limit the analysis to the magnitudes and signi…cance of the turnover and the illiquidity coe¢cients across quintiles, in particular the di¤erences between glamour and value stocks. We …rst notice that illiquidity costs are only signi…cant and positive for quintiles 3 to 5 (NASDAQ), suggesting that glamour stocks are not a¤ected by illiquidity costs.[46] We show that turnover is signi…cant and negative for all BK/MKT groups and the volume premium is higher for quintile 1 (glamour) when compared to quintile 5 (value): for all stocks (NASDAQ stocks), the premium for holding a low volume stock among glamour stocks is 1.19% (1.27%) while the premium is 0.85% (0.78%) for holding a low volume stock among value stocks. Even though the high-volume premium does not decrease monotonically from quintile 1 to quintile 5, it is still higher for glamour stocks when compared to value stocks.

Strictly speaking, the speculative trading theory would predict an insigni…cant e¤ect of turnover for value stocks, since there should be no speculative trading among these stocks. We observe a signi…cant e¤ect of turnover for value stocks, but we think that this might be a result of a broad de…nition of value stocks, de…ned by BK/MKT quintiles instead of deciles. Unfortunately, a regression analysis by deciles would require additional data. Our results do not contradict the main prediction relating overvaluation and turnover, as stated in Hypothesis 2. Moreover, the e¤ect of turnover not attributable to liquidity is stronger for glamour stocks. However, the di¤erences among quintiles are not monotonically decreasing and there is a signi…cant e¤ect for value stocks, which cannot be explained solely by speculative trading.

D. Turnover e¤ect during 1998-2002 - NASDAQ stocks

[46] We con…rm the poor performance of the quoted spread in capturing illiquidity.

We present some interesting findings for NASDAQ stocks during 1998-2002, relating turnover, future stock returns and past returns. The theory tested in this paper provides cross-sectional results for the relationship between turnover and cross-sectional returns, assuming that differences of opinion (i.e. the overconfidence parameter) are constant over time. Therefore, we do not attempt to provide tests regarding the evolution of the overconfidence coefficient over time, but we present some evidence suggesting that there is a qualitative change in the relationship between past turnover and returns after 1998.

In Figure 5, we plot cross-sectional statistics for the observed turnover variable[47] for NASDAQ and NYSE stocks. As shown before (Cochrane (2002)), turnover increases during 1998-2000, achieving a peak around March 2000.[48]. However, if we observe the evolution of illiquidity costs over the same time period, there are no peaks of comparable magnitude.

In fact, during 1998-2002 we observe[49] that the standard errors of the turnover regression coefficient are more volatile across months and the parameter estimates are not consistently negative, a result that is not explained by any of the theories mentioned in this paper. This seems to be a counter-intuitive result since one would expect a higher degree of overvaluation during the Nasdaq bubble and hence, a stronger (i.e. more negative) effect of past turnover on cross-sectional returns. Therefore, our results might suggest a qualitative change in the relationship between returns and turnover, but this might be a temporary effect.

We analyze one possible explanation in Figure 6. We plot the time-series evolution of the cross-sectional correlation between momentum and turnover. We observe that the correlation is significantly higher from 1998-2000. The average for this time period is 0.24 while the average is 0.155 for the rest of the sample. One possible interpretation of this result, is that turnover is responding positively to past returns and hence, the effect on future returns is not as significant as before. In the context of the speculative trading theory, this might suggest an evolution of the overconfidence parameter over time, if we assume that higher past returns proxy for increasing overconfidence and hence for higher turnover. A complete explanation is not in the scope of this paper, but Figure 6 presents an interesting finding to be explained by the trading volume literature.

[47] as defined in Section 5.

[48] Cochrane (2002) presents a similar graph for all Nasdaq stocks, showing that share volume increased from December 1999 to April 2000.

[49] In unreported results.

6 Conclusions

This paper empirically evaluates the e¤ects of trading activity on cross-sectional expected stock returns for a large sample of NYSE and NASDAQ stocks between 1993 and 2002. We contribute to previous research in illiquidity and asset pricing by evaluating the e¤ects of trading activity controlling for illiquidity costs instead of assuming that trading activity is solely a proxy for liquidity. We test the implications of a model that combines heterogeneous beliefs and short-sales constraints, and predicts that turnover rates increase with overcon…dence and with overvaluation. We test the implications of the model by …rst estimating a measure of illiquidity costs using intraday data and following models of price impact of a trade.

Our main results are summarized as follows: we show a strong and negative e¤ect of turnover on cross-sectional returns for NASDAQ and NYSE stocks. We …nd that illiquidity is strongly related to …rm size, while the impact of trading activity on returns is signi…cant even among the largest …rms. Turnover is higher for glamour stocks and the premium for holding a low volume stock is higher for glamour stocks, when compared to value stocks. We also …nd evidence of a premium for value stocks, which is not explained by the speculative trading theory. We show that average illiquidity costs are only signi…cant for the smallest …rms and we con…rm the poor performance of the quoted bid-ask spread in capturing cross-sectional liquidity variation for this particular sample period. Finally, we provide some evidence suggesting a signi…cant change in the qualitative e¤ect of turnover on returns after 1998.

There are many open questions in the trading volume literature. Important topics include the evaluation of the relationship between the speculative component and other proxies of overvaluation and di¤erences of opinion, the analysis of liquidity risk and speculative trading risk and the causality between past returns and past turnover in cross-sectional expected returns. We think that this paper provides evidence to motivate further research in this direction, i.e. focusing on the importance of trading activity for asset returns beyond the liquidity-based explanation.

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APPENDIX

A. The Model for Illiquidity Costs

We follow Glosten and Harris (1988) in deriving the price impact of a trade, as described in (1). Trading costs due to adverse selection are permanent trading costs since they a¤ect the dynamics of the expected value of the security for the uninformed market maker (the "true price process"). Trading costs related to order processing costs and market makers' pro…ts are transitory trading costs since they only a¤ect the level of actual prices.

Let D_k be a buyer-seller indicator variable that equals $+1(-1)$ if transaction k is buyer-initiated (seller-initiated), q_k be the order ‡ow of transaction k and e_k be a public signal. The market maker's expected value of the security given the available information is de…ned as: $E[v_{k+1}|D_k, q_k, e_k] := v_k$ (the "true price process" in Glosten and Harris (1988)). The model considers a linear speci…cation for the expected value and a linear speci…cation for permanent and transitory costs. Permanent costs (denoted as Z_k) are decomposed into a …xed (λ_2) and a variable (λ_1) component. Transitory costs (denoted as C_k) are decomposed into a …xed (φ_1) and a variable (φ_2) component as follows:

$$v_k = v_{k-1} + e_k + D_k Z_k \tag{A1}$$

$$Z_k = \lambda_2 + \lambda_1 q_k \tag{A2}$$

$$C_k = \varphi_1 + \varphi_2 q_k \tag{A3}$$

The observed transaction price includes transitory costs, while adverse selection costs are permanently incorporated into the updated beliefs of the market maker, i.e:

$$P_k = v_k + D_k C_k \tag{A4}$$

Equations (A1)-(A4) imply that the price change from transaction $k-1$ to transaction k, $\Delta P_k = P_k - P_{k-1}$ is given by:

$$\Delta P_k = \lambda_1 D_k q_k + \lambda_2 D_k + \varphi_1 (D_k - D_{k-1}) + \varphi_2 (D_k q_k - D_{k-1} q_{k-1}) + e_k \qquad (1)$$

Evaluating (1) for $D_{k-1} = 1$ and $D_k = -1$, we have the round-trip price change for a sale that immediately follows a purchase of equal size.

B. Intraday Data - Filtering and Additional Summary Statistics

The filtering for selecting stocks remove a considerable number of stocks from the original sample, in particular the restrictions that prices should be higher that $2 and that there should be at least 60 transactions on a stock for each month. On average, we remove 30% of Nasdaq stocks each month and 10% of NYSE stocks each month.

On the other hand, the applied filters for transactions and quotes described in Section 4.1 remove a small percentage of all transactions reported each day. For example, in January 1997 we retain 6,030,274 trades for Nasdaq stocks after filtering, from an original dataset of 6,140,496 transactions, i.e. the filters remove around 1.8% of the transactions. For the same month, the filters delete 2.2% of the 4,842,691 reported transactions on NYSE stocks.

We present summary statistics for the average transaction price and for additional liquidity characteristics in Tables 2 and 3, Panel A. We report means, medians and standard deviations for the quoted bid-ask spread (in dollars), the average daily transaction price (in dollars) and the average transaction size (in number of shares) for all NYSE and NASDAQ stocks included in the sample. We first average across all transactions in a stock that satisfy the filtering described in Section 4.1 in a given day. Monthly averages are then calculated for each stock and cross-sectional monthly statistics are calculated. We report time series averages of monthly cross-sectional statistics. As expected, Nasdaq stocks have lower price, lower average trade size and higher quoted bid-ask spread.

FIGURE 1: Illiquidity Costs - NYSE

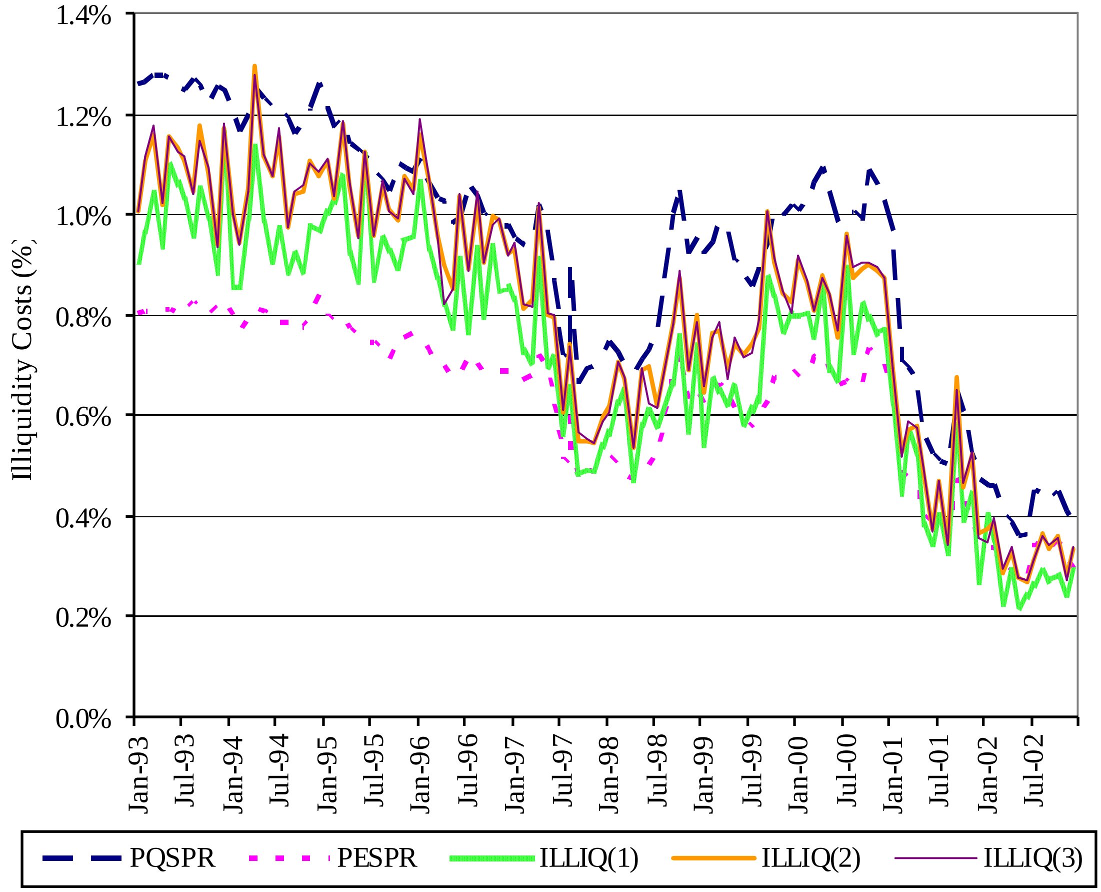

FIGURE 2: Illiquidity Costs - Nasdaq

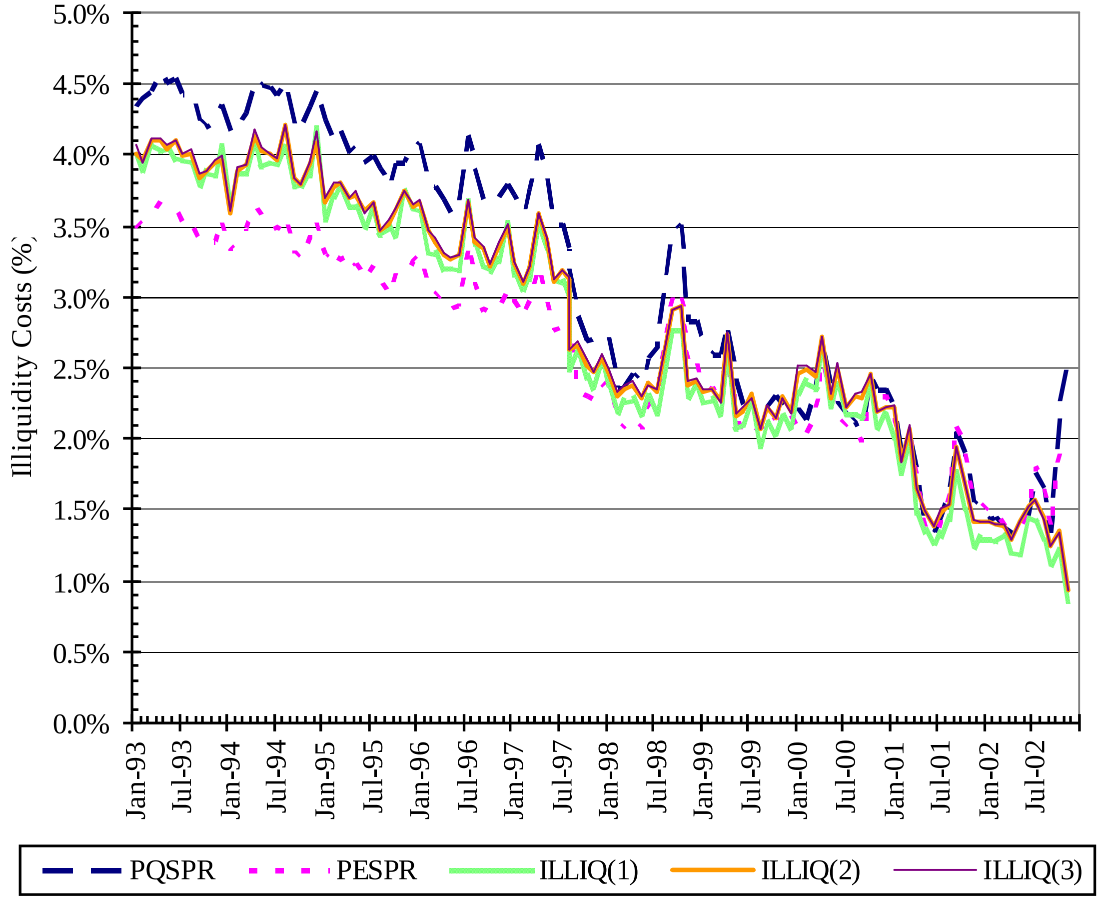

FIGURE 3: Illiquidity Costs - NYSE & Nasdaq

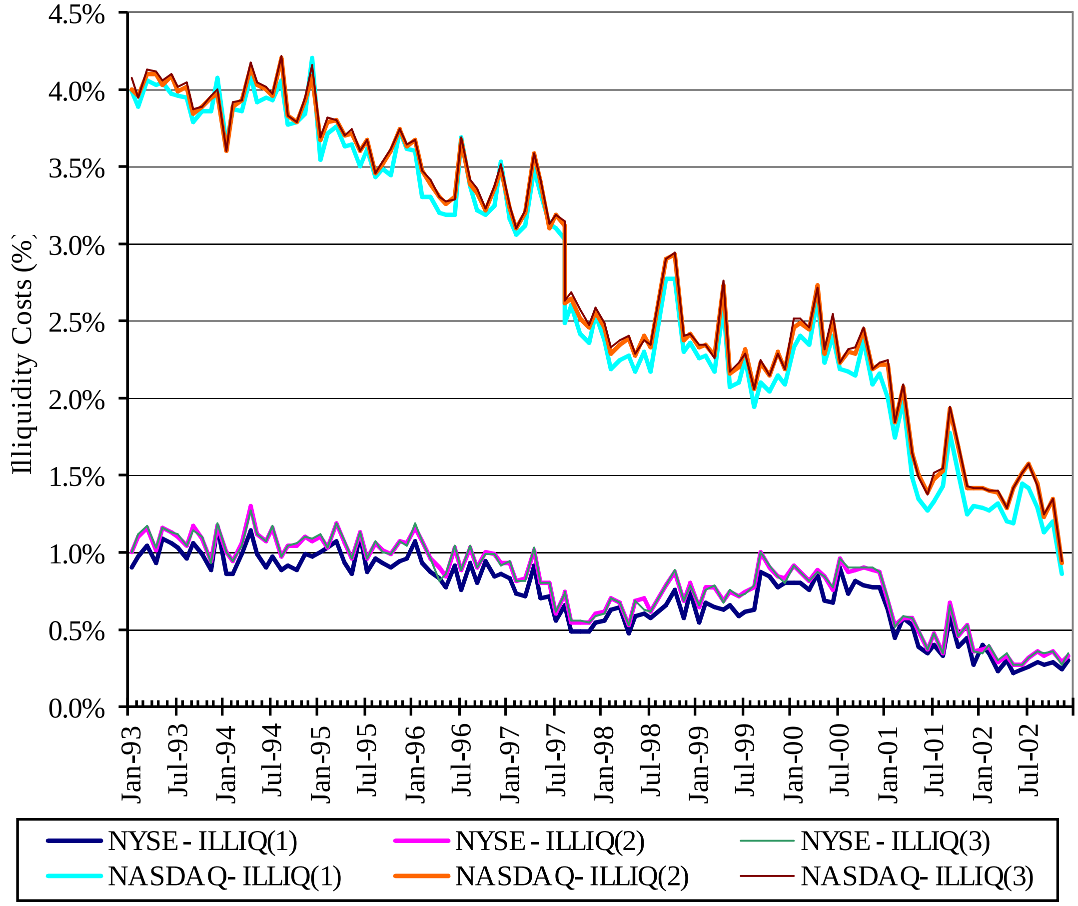

FIGURE 4: Permanent and Transitory Components of Illiquidity Costs - NYSE

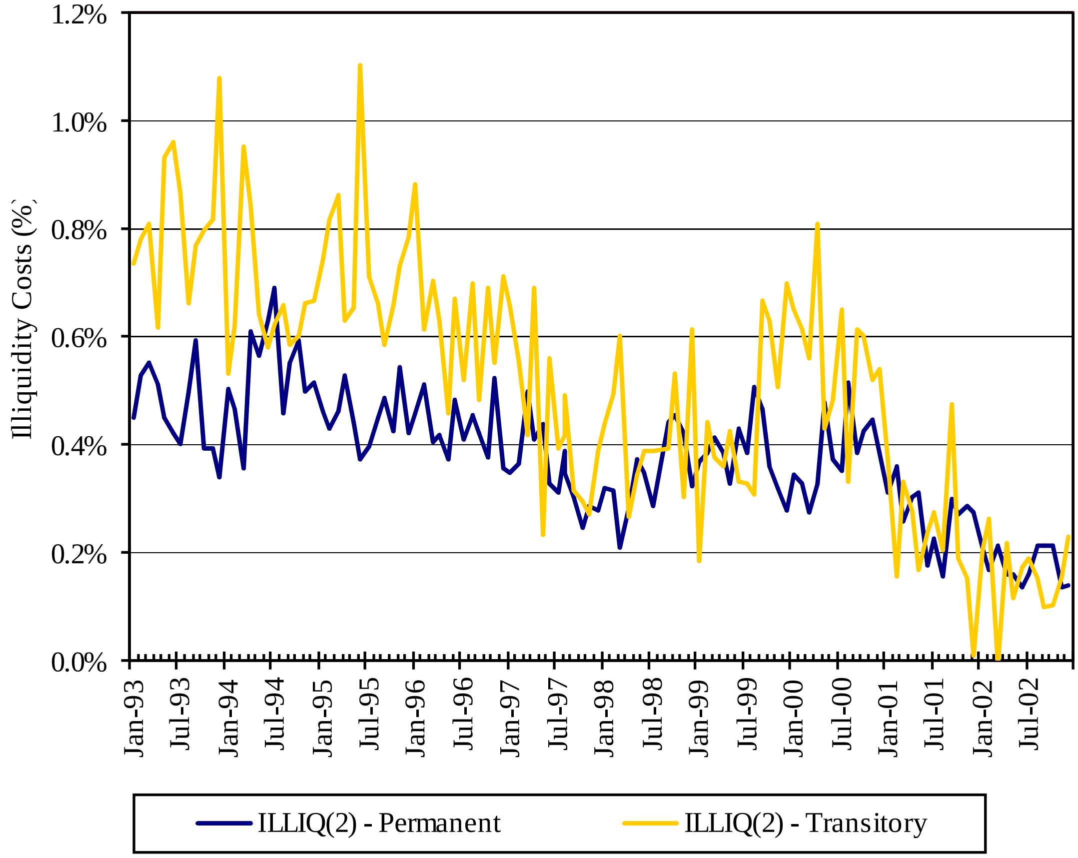

FIGURE 5: NASDAQ - Turnover cross-sectional statistics

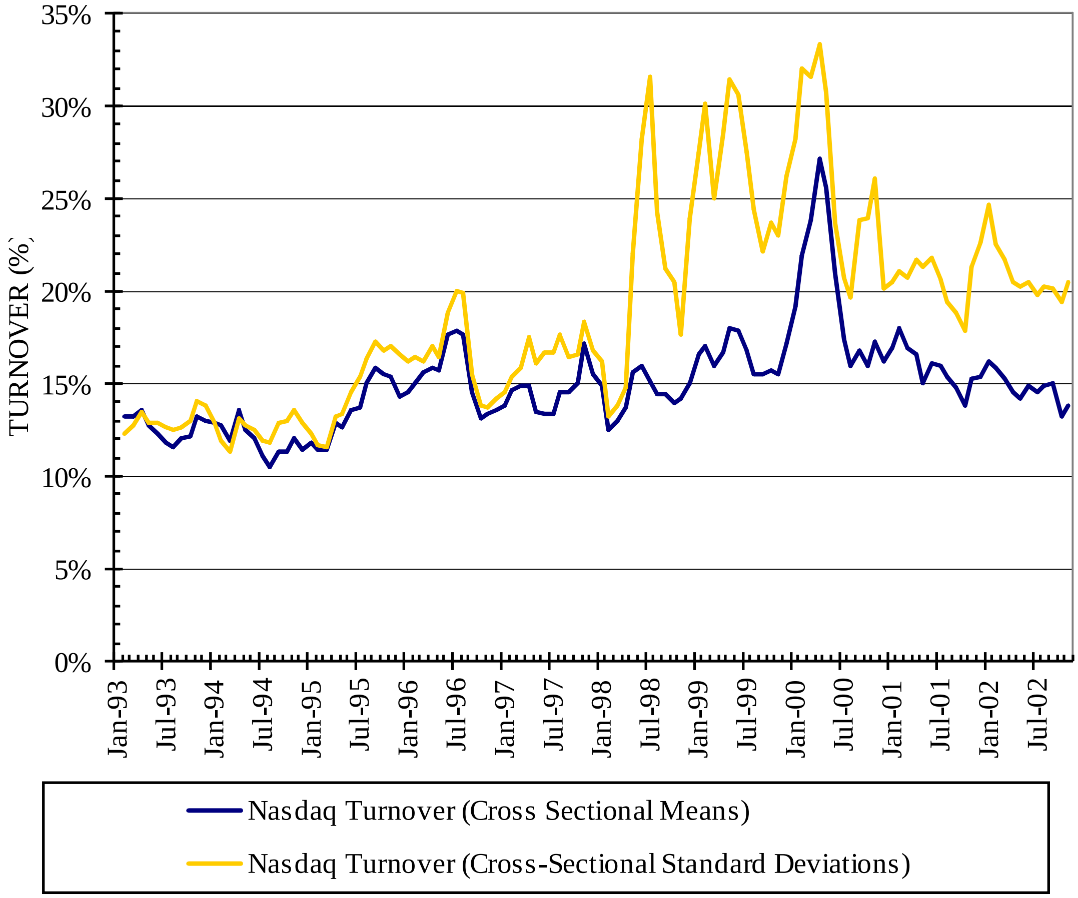

FIGURE 7: NASDAQ - Cross-sectional correlation: TURNOVER and MOMENTUM6

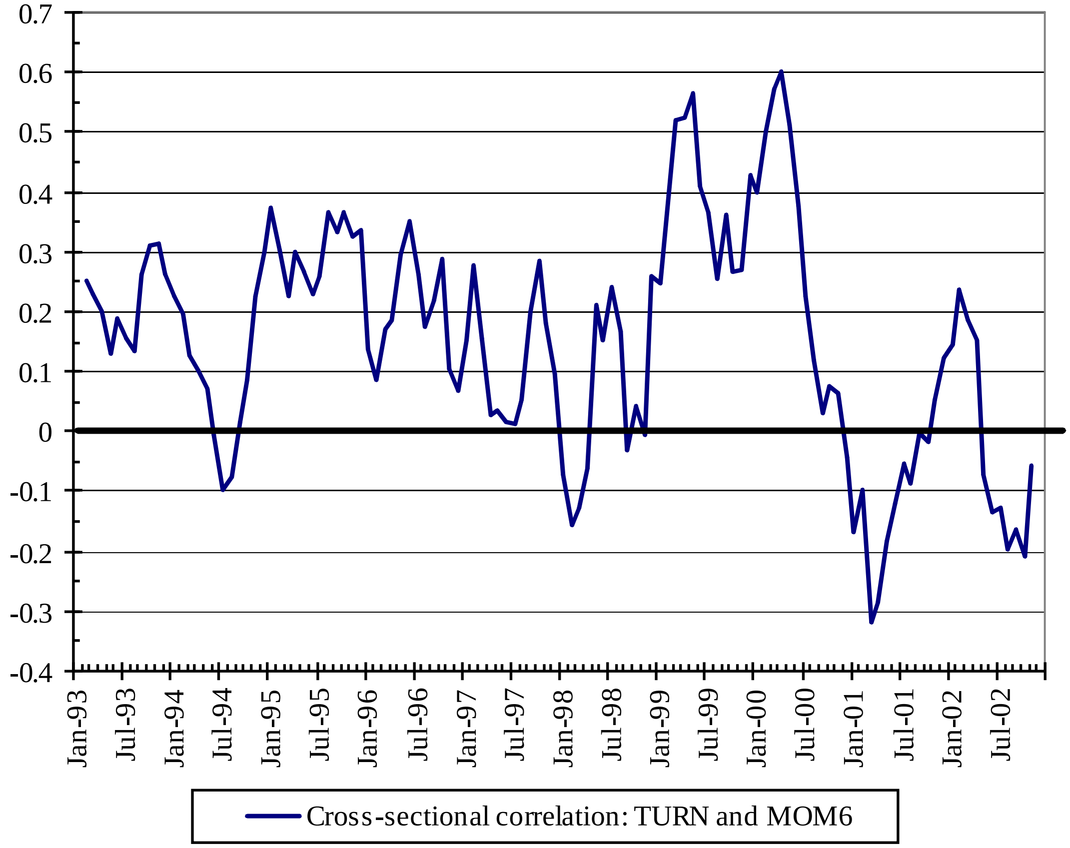

TABLE 1: Summary Statistics - All Stocks

PANEL A: Means and standard deviations

	Mean	Std. Dev.		Mean	Std. Dev.
RET	1.12%	15.6%	ILLIQ(1)	2.00%	3.92%
SIZE	12.55	1.827	ILLIQ(2)	2.08%	3.90%
BK/MKT	0.632	0.679	ILLIQ(3)	2.09%	4.00%
XTURN	1.62%	15.6%	PQSPR	2.28%	2.16%
MOM6	10.0%	45.9%	PESPR	1.88%	1.88%

PANEL B: Correlations

	SIZE	BK/MKT	XTURN	MOM6	ILLIQ(1)	ILLIQ(2)	ILLIQ(3)	PQSPR	PESPR
RET	-0.022	0.031	-0.032	0.019	0.015	0.017	0.016	0.022	0.019
SIZE		-0.229	0.143	0.053	-0.351	-0.372	-0.361	-0.730	-0.722
BK/MKT			-0.124	0.055	0.091	0.097	0.096	0.163	0.150
XTURN				0.146	-0.113	-0.121	-0.118	-0.239	-0.228
MOM6					-0.046	-0.045	-0.044	-0.091	-0.084
ILLIQ(1)						0.933	0.927	0.554	0.554
ILLIQ(2)							0.987	0.568	0.567
ILLIQ(3)								0.561	0.560
PQSPR									0.988

The sample includes stocks from NYSE and NASDAQ between 02/1993 and 12/2002. Time-series averages of monthly cross-sectional summary statistics are reported in Panel A and time-series averages of monthly cross-sectional correlations are reported in Panel B. RET is month-t raw return. SIZE is the logarithm of market capitalization at the end of month t-1. BM/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. XTURN is the average of share turnover for t-1 to t-3 demeaned each month by the average turnover for the firm's exchange. MOM6 is the six-month cumulative holding period return to the end of month t-1. ILLIQ(m), m=1,2,3 are the monthly illiquidity costs estimates for month t-1 for each trade indicator model as defined in (2)-(4). PQSPR and PESPR are, respectively the monthly averages of the (daily) average proportional quoted spread, and proportional effective spread at month t-1, considering all transactions that satisfy the data filters described in the text.

TABLE 2: Summary Statistics - NYSE Stocks

PANEL A: Means and standard deviations

	Mean	Std. Dev.		Mean	Std. Dev.
RET	0.92%	11.2%	ILLIQ(1)	0.72%	2.15%
SIZE	13.77	1.681	ILLIQ(2)	0.81%	2.30%
BK/MKT	0.649	0.636	ILLIQ(3)	0.81%	2.31%
TURN	7.85%	7.03%	PQSPR	0.93%	0.84%
MOM6	6.66%	29.25%	PESPR	0.63%	0.60%
			QSPR	0.165	0.075
			PRICE	29.34	25.01
			TR. SIZE	1396.9	794.4

PANEL B: Correlations

	SIZE	BK/MKT	TURN	MOM6	ILLIQ(1)	ILLIQ(2)	ILLIQ(3)	PQSPR	PESPR
RET	-0.007	0.012	-0.014	0.008	0.003	0.006	0.006	0.004	0.002
SIZE		-0.344	0.093	0.096	-0.292	-0.307	-0.306	-0.709	-0.690
BK/MKT			-0.066	0.033	0.139	0.147	0.147	0.288	0.284
TURN				0.058	-0.071	-0.082	-0.081	-0.128	-0.115
MOM6					-0.064	-0.063	-0.062	-0.153	-0.155
ILLIQ(1)						0.908	0.889	0.464	0.460
ILLIQ(2)							0.981	0.481	0.476
ILLIQ(3)								0.480	0.476
PQSPR									0.982

The sample includes NYSE-listed stocks between 02/1993 and 12/2002. Time-series averages of monthly cross-sectional summary statistics are reported in Panel A and time-series averages of monthly cross-sectional correlations are reported in Panel B. RET is month-t raw return. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average of share turnover for t-1 to t-3. MOM6 is the six-month cumulative holding period return to the end of month t-1. ILLIQ(m), m=1,2,3 are the monthly illiquidity costs estimates for month t-1 for each trade indicator model as defined in (2)-(4). PQSPR, PESPR, and QSPR are, respectively the monthly averages of the (daily) average proportional quoted spread, proportional effective spread, and quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. PRICE is the average daily transaction price at month t-1 (in dollars) and TR. SIZE is the average transaction size at month t-1 (in number of shares).

TABLE 3: Summary Statistics - NASDAQ Stocks

PANEL A: Means and standard deviations

	Mean	Std. Dev.		Mean	Std. Dev.
RET	1.29%	17.6%	ILLIQ(1)	2.74%	4.40%
SIZE	11.79	1.474	ILLIQ(2)	2.83%	4.35%
BK/MKT	0.621	0.684	ILLIQ(3)	2.84%	4.48%
TURN	15.0%	18.9%	PQSPR	3.08%	2.29%
MOM6	12.3%	53.0%	PESPR	2.61%	1.99%
			QSPR	0.327	0.278
			PRICE	16.12	14.86
			TR. SIZE	1243.2	731.9

PANEL B: Correlations

	SIZE	BK/MKT	TURN	MOM6	ILLIQ(1)	ILLIQ(2)	ILLIQ(3)	PQSPR	PESPR
RET	-0.032	0.040	-0.036	0.021	0.017	0.018	0.018	0.026	0.023
SIZE		-0.250	0.288	0.084	-0.332	-0.354	-0.342	-0.718	-0.716
BK/MKT			-0.149	0.066	0.100	0.105	0.103	0.188	0.186
TURN				0.156	-0.148	-0.158	-0.153	-0.339	-0.333
MOM6					-0.057	-0.056	-0.054	-0.120	-0.117
ILLIQ(1)						0.93	0.927	0.525	0.529
ILLIQ(2)							0.988	0.541	0.544
ILLIQ(3)								0.534	0.537
PQSPR									0.988

The sample includes NASDAQ-listed stocks between 02/1993 and 12/2002. Time-series averages of monthly cross-sectional summary statistics are reported in Panel A and time-series averages of monthly cross-sectional correlations are reported in Panel B. RET is month-t raw return. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average of share turnover for t-1 to t-3. MOM6 is the six-month cumulative holding period return to the end of month t-1. ILLIQ(m), m=1,2,3 are the monthly illiquidity costs estimates for month t-1 for each trade indicator model as defined in (2)-(4). PQSPR, PESPR, and QSPR are, respectively the monthly averages of the (daily) average proportional quoted spread, proportional effective spread, and quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. PRICE is the average daily transaction price at month t-1 (in dollars) and TR. SIZE is the average transaction size at month t-1 (in number of shares).

TABLE 4A: Effects of Lagged Turnover and Illiquidity on Cross-Sectional Returns:
Regression Results - All Stocks

	SIZE	BK/MKT	NYTURN	NDQTURN	PQSPR	ILLIQ(1)	ILLIQ(2)	MOM6
Coefficient	-0.0004	0.0026	-0.0504	-0.0397				0.0056
t-stat	-2.81	6.47	-10.14	-18.22				7.08
Economic Signif.	-0.080%	0.175%	-0.354%	-0.750%				0.258%
Coefficient	-0.0002	0.0027	-0.0456	-0.0386	0.0172			0.0056
t-stat	-0.80	6.81	-8.97	-17.74	0.78			7.01
Economic Signif.		0.184%	-0.320%	-0.729%				0.256%
Coefficient	-0.0003	0.0026	-0.0491	-0.0392		0.0161		0.0057
t-stat	-2.05	6.52	-9.84	-18.04		7.18		7.19
Economic Signif.		0.175%	-0.345%	-0.741%		0.063%		0.262%
Coefficient	-0.0003	0.0026	-0.0488	-0.0391			0.0206	0.0057
t-stat	-1.70	6.51	-9.80	-18.00			7.32	7.18
Economic Signif.		0.175%	-0.343%	-0.740%			0.080%	0.262%

The sample includes stocks from NYSE and NASDAQ between 02/1993 and 12/2002. Weighted average slopes and associated t-statistics of monthly cross-sectional regressions of raw returns on turnover, illiquidity costs, book-to-market and firm size are calculated as in (5)-(7). *Economic Signif.* is the estimated effect of one standard deviation increase of the corresponding explanatory variable on returns. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average share turnover from t-1 to t-3. NYTURN is equal to TURN if the stock is listed on NYSE and it equals zero otherwise. NDQTURN is equal to TURN if the stock is listed on NASDAQ and it equals zero otherwise. PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. ILLIQ(m), m=1,2 are the monthly illiquidity costs estimates for month t-1 for the trade indicator models as defined in (2) and (3). MOM6 is the six-month cumulative holding period return to the end of month t-1.

TABLE 4B: Effects of Lagged Turnover and Illiquidity on Cross-Sectional Returns:
Regression Results - NYSE Stocks

	SIZE	BK/MKT	TURN	PQSPR	ILLIQ(1)	ILLIQ(2)	MOM6
Coefficient	0.0003	0.0005	-0.0480				0.0056
t-stat	1.57	0.87	-8.89				3.99
Economic Signif.			-0.338%				0.165%
Coefficient	-0.0005	0.0011	-0.0515	-0.2615			0.0040
t-stat	-1.81	2.00	-9.46	-4.02			2.83
Economic Signif.			-0.362%	-0.220%			0.116%
Coefficient	0.0002	0.0005	-0.0484		0.0375		0.0055
t-stat	1.22	1.00	-8.96		4.21		3.91
Economic Signif.			-0.340%		0.081%		0.161%
Coefficient	0.0003	0.0005	-0.0480			0.0077	0.0056
t-stat	1.68	1.01	-8.88			0.74	3.95
Economic Signif.			-0.337%				0.163%

The sample includes NYSE-listed stocks between 02/1993 and 12/2002. Weighted average slopes and associated t-statistics of monthly cross-sectional regressions of raw returns on turnover, illiquidity costs, book-to-market and firm size are calculated as in (5)-(7). *Economic Signif.* is the estimated effect of one standard deviation increase of the corresponding explanatory variable on returns. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average share turnover from t 1 to t-3. PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. ILLIQ(m), m=1,2 are the monthly illiquidity costs estimates for month t-1 for the trade indicator models as defined in (2) and (3). MOM6 is the six-month cumulative holding period return to the end of month t-1.

TABLE 4C: Effects of Lagged Turnover and Illiquidity on Cross-Sectional Returns: Regression Results - NASDAQ Stocks

	SIZE	BK/MKT	TURN	PQSPR	ILLIQ(1)	ILLIQ(2)	MOM6
Coefficient	-0.0008	0.0031	-0.0387				0.0050
t-stat	-3.16	6.51	-16.37				5.68
Economic Signif.	-0.125%	0.209%	-0.731%				0.266%
Coefficient	-0.0009	0.0031	-0.0369	-0.0460			0.0050
t-stat	-2.39	6.65	-15.49	-1.69			5.70
Economic Signif.	-0.126%	0.214%	-0.697%				0.267%
Coefficient	-0.0007	0.0030	-0.0382		0.0084		0.0051
t-stat	-2.43	6.45	-16.13		3.39		5.81
Economic Signif.	-0.100%	0.206%	-0.722%		0.037%		0.272%
Coefficient	-0.0007	0.0030	-0.0382			0.0129	0.0051
t-stat	-2.33	6.48	-16.14			4.10	5.80
Economic Signif.	-0.100%	0.206%	-0.722%			0.056%	0.272%

The sample includes NASDAQ-listed stocks between 02/1993 and 12/2002. Weighted average slopes and associated t-statistics of monthly cross-sectional regressions of raw returns on turnover, illiquidity costs, book-to-market and firm size are calculated as in (5)-(7). *Economic Signif.* is the estimated effect of one standard deviation increase of the corresponding explanatory variable on returns. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average share turnover from t 1 to t-3. PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. ILLIQ(m), m=1,2 are the monthly illiquidity costs estimates for month t-1 for the trade indicator models as defined in (2) and (3). MOM6 is the six-month cumulative holding period return to the end of month t-1.

TABLE 5A: Summary Statistics by Size Quintiles - All Stocks

		Quintile 5 (largest) firms	Quintile 4 firms	Quintile 3 firms	Quintile 2 firms	Quintile 1 (smallest) firms
Avg. Number of Firms		282	334	415	588	1578
RET	*Mean*	0.82%	0.84%	0.76%	0.92%	1.43%
	Std. Dev.	9.4%	11.4%	12.9%	14.5%	17.9%
SIZE	*Mean*	16.21	14.61	13.66	12.78	11.06
	Std. Dev.	0.855	0.311	0.245	0.267	0.853
BK/MKT	*Mean*	0.393	0.462	0.499	0.589	0.768
	Std. Dev.	0.302	0.350	0.396	0.692	0.755
XTURN	*Mean*	3.28%	5.46%	4.87%	3.16%	-1.02%
	Std. Dev.	12.9%	16.2%	17.1%	15.8%	14.1%
NYTURN	*Mean*	8.04%	9.53%	8.40%	7.29%	5.98%
	Std. Dev.	5.52%	7.16%	7.52%	7.25%	6.29%
NDQTURN	*Mean*	31.8%	27.2%	23.1%	18.1%	11.5%
	Std. Dev.	24.5%	26.3%	23.6%	19.3%	15.0%
MOM6	*Mean*	11.7%	12.2%	13.1%	12.3%	7.50%
	Std. Dev.	28.1%	36.0%	40.4%	46.1%	49.5%
ILLIQ(1)	*Mean*	0.23%	0.39%	0.63%	1.07%	3.47%
	Std. Dev.	0.18%	0.27%	0.56%	0.90%	7.21%
ILLIQ(2)	*Mean*	0.24%	0.41%	0.67%	1.13%	3.59%
	Std. Dev.	0.17%	0.27%	0.59%	0.91%	6.95%
PQSPR	*Mean*	0.32%	0.54%	0.85%	1.37%	3.59%
	Std. Dev.	0.13%	0.25%	0.43%	0.71%	2.27%

The sample includes stocks from NYSE and NASDAQ between 02/1993 and 12/2002. Time-series averages of monthly cross-sectional summary statistics are reported. All stocks are included and size quintiles are defined monthly by NYSE breakpoints. RET is month-t raw return. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average share turnover from t-1 to t-3. XTURN is the average of share turnover for t-1 to t-3 demeaned each month by the average turnover for the firm's exchange. NYTURN is equal to TURN if the stock is listed on NYSE and it equals zero otherwise. NDQTURN is equal to TURN if the stock is listed on NASDAQ and it equals zero otherwise. MOM6 is the six-month cumulative holding period return to the end of month t-1. ILLIQ(m), m=1,2 are the monthly illiquidity costs estimates for month t-1 for the trade indicator models as defined in (2) and (3). PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text.

TABLE 5B: Summary Statistics by Size Quintiles - NASDAQ Stocks

		Quintile 5 (largest) firms	Quintile 4 firms	Quintile 3 firms	Quintile 2 firms	Quintile 1 (smallest) firms
Avg. Number of Firms		403	404	404	404	404
RET	*Mean*	0.80%	0.98%	1.26%	1.18%	2.25%
	Std. Dev.	14.8%	16.3%	16.9%	17.8%	20.4%
SIZE	*Mean*	13.98	12.48	11.68	10.93	9.90
	Std. Dev.	0.924	0.265	0.214	0.220	0.500
BK/MKT	*Mean*	0.391	0.527	0.607	0.707	0.873
	Std. Dev.	0.348	0.652	0.588	0.640	0.759
TURN	*Mean*	24.4%	17.2%	13.4%	10.6%	9.2%
	Std. Dev.	24.0%	18.9%	16.7%	13.4%	11.5%
MOM6	*Mean*	20.5%	15.8%	10.9%	8.1%	6.2%
	Std. Dev.	49.9%	53.6%	49.4%	50.5%	52.4%
ILLIQ(1)	*Mean*	0.85%	1.57%	2.27%	3.30%	6.38%
	Std. Dev.	0.49%	0.98%	1.68%	3.58%	12.23%
ILLIQ(2)	*Mean*	0.88%	1.61%	2.32%	3.35%	6.58%
	Std. Dev.	0.52%	0.95%	1.61%	3.07%	11.93%
PQSPR	*Mean*	1.01%	1.89%	2.72%	3.73%	5.83%
	Std. Dev.	0.55%	0.83%	1.14%	1.59%	2.73%

The sample includes NASDAQ-listed stocks between 02/1993 and 12/2002. Time-series averages of monthly cross-sectional summary statistics are reported. Size quintiles are defined monthly by NASDAQ breakpoints. RET is month-t raw return. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average share turnover from t-1 to t-3. MOM6 is the six-month cumulative holding period return to the end of month t-1. ILLIQ(m), m=1,2 are the monthly illiquidity costs estimates for month t-1 for the trade indicator models as defined in (2) and (3). PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text.

TABLE 6A: Effects of Lagged Turnover and Illiquidity on Cross-Sectional Returns: Regression Results by Size Quintiles - All Stocks

	SIZE	BK/MKT	XTURN	PQPSR	ILLIQ(2)	MOM6
Size Quintile 1 (smallest)						
Coefficient	-0.0043	0.0038	-0.0475			0.0094
t-stat	-8.04	6.77	-14.54			8.77
Low-High Volume Premium			0.98%			
Coefficient	-0.0060	0.0038	-0.0463	-0.0976		0.0092
t-stat	-8.68	6.84	-14.07	-3.43		8.58
Low-High Volume Premium			0.96%			
Coefficient	-0.0041	0.0038	-0.0470		0.0121	0.0095
t-stat	-7.34	6.75	-14.38		4.14	8.90
Low-High Volume Premium			0.97%			
Size Quintile 2						
Coefficient	-0.0018	0.0012	-0.0378			0.0029
t-stat	-0.94	4.10	-8.31			1.88
Low-High Volume Premium			1.10%			
Coefficient	-0.0052	0.0012	-0.0436	-0.3060		0.0030
t-stat	-2.67	3.98	-9.21	-4.93		1.97
Low-High Volume Premium			1.26%			
Coefficient	-0.0038	0.0011	-0.0412		-0.1300	0.0029
t-stat	-1.96	3.77	-8.94		-3.61	1.90
Low-High Volume Premium			1.19%			
Size Quintile 3						
Coefficient	-0.0045	-0.0001	-0.0363			-0.0027
t-stat	-2.18	-0.07	-9.09			-1.45
Low-High Volume Premium			1.02%			
Coefficient	-0.0060	-0.0001	-0.0388	-0.1693		-0.0025
t-stat	-2.83	-0.11	-9.53	-1.79		-1.40
Low-High Volume Premium			1.09%			
Coefficient	-0.0049	0.0000	-0.0368		0.1070	-0.0030
t-stat	-2.34	0.04	-9.19		2.15	-1.62
Low-High Volume Premium			1.03%			
Size Quintile 4						
Coefficient	-0.0001	-0.0007	-0.0254			0.0015
t-stat	-0.05	-0.49	-6.09			0.80
Low-High Volume Premium			0.64%			
Coefficient	-0.0012	0.0000	-0.0260	-0.3956		0.0012
t-stat	-0.71	-0.02	-6.17	-2.38		0.60
Low-High Volume Premium			0.66%			
Coefficient	-0.0014	0.0002	-0.0264		-0.3877	0.0012
t-stat	-0.88	0.12	-6.38		-3.66	0.65
Low-High Volume Premium			-0.16%			
Size Quintile 5 (largest)						
Coefficient	0.0004	-0.0003	-0.0257			-0.0005
t-stat	0.73	-0.23	-5.07			-0.21
Low-High Volume Premium			0.46%			
Coefficient	-0.0007	0.0003	-0.0249	-0.7186		-0.0025
t-stat	-1.16	0.19	-4.83	-2.13		-1.03
Low-High Volume Premium			0.45%			
Coefficient	-0.0003	0.0000	-0.0264		-0.0627	-0.0022
t-stat	-0.67	-0.01	-5.26		-3.10	-0.91
Low-High Volume Premium			0.48%			

The sample includes stocks from NYSE and NASDAQ between 02/1993 and 12/2002. Weighted average slopes and associated t-statistics of monthly cross-sectional regressions of raw returns on turnover, illiquidity costs, book-to-market and firm size are calculated as in (5) (7), for each size quintile. Low-High Volume Premium is the turnover coefficient times the difference between the 10th turnover percentile and the 90th turnover percentile for each size quintile. All stocks are included and size quintiles are defined monthly by NYSE breakpoints. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. XTURN is the average of share turnover for t-1 to t-3 demeaned each month by the average turnover for the firm's exchange. PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. ILLIQ(2) is the monthly illiquidity costs estimates for month t-1 as defined in (3). MOM6 is the is six-month cumulative holding period return to the end of month t-1.

TABLE 6B: Effects of Lagged Turnover and Illiquidity on Cross-Sectional Returns: Regression Results by Size Quintiles - NASDAQ Stocks

	SIZE	BK/MKT	TURN	PQPSR	ILLIQ(2)	MOM6
Size Quintile 1 (smallest)						
Coefficient	-0.0133	0.0073	-0.0841			0.0053
t-stat	-6.79	6.46	-11.32			2.82
Low-High Volume Premium			1.36%			
Coefficient	-0.0167	0.0075	-0.0773	-0.1565		0.0050
t-stat	-7.83	6.61	-10.41	-3.70		2.67
Low-High Volume Premium			1.25%			
Coefficient	-0.0132	0.0074	-0.0833		0.0140	0.0056
t-stat	-6.65	6.52	-11.21		5.04	3.00
Low-High Volume Premium			1.35%			
Size Quintile 2						
Coefficient	-0.0036	0.0010	-0.0628			0.0098
t-stat	-1.03	1.19	-10.66			5.24
Low-High Volume Premium			1.24%			
Coefficient	-0.0092	0.0008	-0.0762	-0.3673		0.0096
t-stat	-2.61	0.97	-11.55	-7.11		5.16
Low-High Volume Premium			1.50%			
Coefficient	-0.0055	0.0010	-0.0687		-0.1116	0.0096
t-stat	-1.57	1.20	-10.54		-5.79	5.14
Low-High Volume Premium			1.36%			
Size Quintile 3						
Coefficient	-0.0028	0.0043	-0.0391			0.0085
t-stat	-0.83	4.26	-9.98			4.56
Low-High Volume Premium			1.04%			
Coefficient	-0.007	0.004	-0.040	-0.302		0.008
t-stat	-2.07	4.01	-11.00	-4.75		4.37
Low-High Volume Premium			1.07%			
Coefficient	-0.004	0.004	-0.040		-0.017	0.008
t-stat	-1.26	4.11	-10.24		-0.64	4.55
Low-High Volume Premium			1.06%			
Size Quintile 4						
Coefficient	-0.0015	0.0011	-0.0393			0.0025
t-stat	-0.58	4.26	-8.42			1.57
Low-High Volume Premium			1.41%			
Coefficient	-0.0056	0.0011	-0.0469	-0.3133		0.0025
t-stat	-2.04	4.28	-9.47	-4.04		1.63
Low-High Volume Premium			1.68%			
Coefficient	-0.0048	0.0009	-0.0399		-0.1289	0.0024
t-stat	-1.79	3.53	-10.24		-2.68	1.59
Low-High Volume Premium			1.43%			
Size Quintile 5 (largest)						
Coefficient	0.0014	-0.0006	-0.0304			-0.0008
t-stat	2.27	-0.33	-9.69			-0.49
Low-High Volume Premium			1.65%			
Coefficient	-0.0015	-0.0010	-0.0352	-0.4914		-0.0005
t-stat	-1.97	-0.51	-10.65	-4.80		-0.32
Low-High Volume Premium			1.91%			
Coefficient	-0.0008	-0.0008	-0.0326		-0.4058	-0.0003
t-stat	-1.08	-0.42	-10.06		-5.04	-0.22
Low-High Volume Premium			1.77%			

The sample includes NASDAQ-listed stocks between 02/1993 and 12/2002. Weighted average slopes and associated t-statistics of monthly cross-sectional regressions of raw returns on turnover, illiquidity costs, book-to-market and firm size are calculated as in (5)-(7), for each size quintile. Low-High Volume Premium is the turnover coefficient times the difference between the 10th turnover percentile and the 90th turnover percentile for each size quintile. Size quintiles are defined monthly by NASDAQ breakpoints. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average of share turnover for t-1 to t-3. PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. ILLIQ(2) is the monthly illiquidity costs estimates for month t-1 as defined in (3). MOM6 is the is six-month cumulative holding period return to the end of month t-1.

TABLE 7A: Summary Statistics by BK/MKT Quintiles - All Stocks

		Quintile 5 (value) firms	Quintile 4 firms	Quintile 3 firms	Quintile 2 firms	Quintile 1 (glamour) firms
Avg. Number of Firms		642	597	597	606	755
RET	*Mean*	1.76%	1.32%	1.11%	0.87%	0.67%
	Std. Dev.	15.2%	13.5%	14.1%	15.4%	17.9%
SIZE	*Mean*	11.62	12.34	12.68	12.96	13.09
	Std. Dev.	1.532	1.610	1.662	1.769	2.005
BK/MKT	*Mean*	1.459	0.757	0.530	0.352	0.142
	Std. Dev.	1.058	0.081	0.055	0.049	0.082
XTURN	*Mean*	-1.85%	-1.37%	0.14%	2.89%	7.12%
	Std. Dev.	11.7%	11.6%	12.5%	15.4%	20.3%
NYTURN	*Mean*	6.72%	7.29%	7.82%	8.46%	8.94%
	Std. Dev.	6.65%	7.14%	6.25%	7.19%	6.99%
NDQTURN	*Mean*	10.1%	10.5%	12.6%	16.8%	22.4%
	Std. Dev.	13.7%	13.5%	15.2%	18.7%	23.7%
MOM6	*Mean*	13.0%	9.5%	8.4%	7.9%	11.1%
	Std. Dev.	46.5%	37.5%	38.1%	44.0%	53.1%
ILLIQ(1)	*Mean*	3.04%	2.03%	1.78%	1.63%	1.75%
	Std. Dev.	7.90%	4.72%	3.44%	2.99%	3.52%
ILLIQ(2)	*Mean*	3.17%	2.13%	1.85%	1.68%	1.80%
	Std. Dev.	7.67%	4.82%	3.40%	2.87%	3.39%
PQSPR	*Mean*	2.94%	2.23%	2.04%	1.89%	1.97%
	Std. Dev.	2.46%	2.08%	1.96%	1.89%	1.98%

The sample includes stocks from NYSE and NASDAQ between 02/1993 and 12/2002. Time-series averages of monthly cross-sectional summary statistics are reported. All stocks are included and book-to-market (BK/MKT) quintiles are defined monthly by NYSE breakpoints. RET is month-t raw return. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average share turnover from t-1 to t-3. XTURN is the average of share turnover for t-1 to t-3 demeaned each month by the average turnover for the firm's exchange. NYTURN is equal to TURN if the stock is listed on NYSE and it equals zero otherwise. NDQTURN is equal to TURN if the stock is listed on NASDAQ and it equals zero otherwise. MOM6 is the six-month cumulative holding period return to the end of month t-1. ILLIQ(m), m=1,2 are the monthly illiquidity costs estimates for month t-1 for the trade indicator models as defined in (2) and (3). PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text.

TABLE 7B: Summary Statistics by BK/MKT Quintiles - NASDAQ Stocks

		Quintile 5 (value) firms	Quintile 4 firms	Quintile 3 firms	Quintile 2 firms	Quintile 1 (glamour) firms
Avg. Number of Firms		403	404	404	404	404
RET	*Mean*	2.16%	1.59%	1.13%	0.76%	0.84%
	Std. Dev.	16.5%	15.1%	16.1%	18.2%	20.2%
SIZE	*Mean*	10.98	11.57	11.91	12.15	12.35
	Std. Dev.	1.183	1.247	1.312	1.426	1.658
BK/MKT	*Mean*	1.458	0.742	0.492	0.301	0.114
	Std. Dev.	1.059	0.089	0.060	0.053	0.064
TURN	*Mean*	10.1%	10.4%	13.3%	18.3%	22.9%
	Std. Dev.	13.6%	13.3%	15.7%	19.5%	24.3%
MOM6	*Mean*	16.4%	11.8%	9.3%	10.0%	15.0%
	Std. Dev.	52.1%	43.1%	45.0%	54.1%	61.2%
ILLIQ(1)	*Mean*	4.08%	2.99%	2.62%	2.36%	2.32%
	Std. Dev.	9.18%	5.71%	4.21%	3.63%	3.53%
ILLIQ(2)	*Mean*	4.19%	3.10%	2.67%	2.41%	2.38%
	Std. Dev.	8.86%	5.82%	3.91%	3.42%	3.53%
PQSPR	*Mean*	3.91%	3.15%	2.89%	2.65%	2.59%
	Std. Dev.	2.57%	2.23%	2.09%	2.04%	2.13%

The sample includes NASDAQ-listed stocks between 02/1993 and 12/2002. Time-series averages of monthly cross-sectional summary statistics are reported. Book-to market (BK/MKT) quintiles are defined monthly by NASDAQ breakpoints. RET is month-t raw return. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average share turnover from t-1 to t-3. MOM6 is the six-month cumulative holding period return to the end of month t-1. ILLIQ(m), m=1,2 are the monthly illiquidity costs estimates for month t-1 for the trade indicator models as defined in (2) and (3). PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text.

TABLE 8A: Effects of Lagged Turnover and Illiquidity on Cross-Sectional Returns:
Regression Results by BK/MKT Quintiles - All Stocks

	SIZE	BK/MKT	XTURN	PQPSR	ILLIQ(2)	MOM6
BK/MKT Quintile 1 (glamour)						
Coefficient	0.0027	-0.0049	-0.0344			-0.0006
t-stat	9.99	-0.72	-12.16			-0.50
Low-High Volume Premium			1.20%			
Coefficient	0.0018	-0.0069	-0.0352	-0.1094	-0.1094	-0.0007
t-stat	4.59	-1.02	-12.25	-2.20	-2.20	-0.59
Low-High Volume Premium			1.23%			
Coefficient	0.0024	-0.0066	-0.0342		-0.0145	-0.0006
t-stat	8.16	-0.98	-12.02		-1.30	-0.50
Low-High Volume Premium			1.19%			
BK/MKT Quintile 2						
Coefficient	0.0016	0.0192	-0.0339			0.0042
t-stat	5.13	1.75	-8.00			2.67
Low-High Volume Premium			0.88%			
Coefficient	-0.0001	0.0185	-0.0351	-0.1566		0.0038
t-stat	-0.14	1.69	-8.16	-2.92		2.41
Low-High Volume Premium			0.91%			
Coefficient	0.0016	0.0197	-0.0341		0.0358	0.0042
t-stat	4.59	1.80	-8.01		2.61	2.70
Low-High Volume Premium			0.89%			
BK/MKT Quintile 3						
Coefficient	0.0009	0.0237	-0.0613			0.0026
t-stat	2.67	2.58	-11.81			1.41
Low-High Volume Premium			1.31%			
Coefficient	-0.0004	0.0226	-0.0636	-0.2086		0.0021
t-stat	-0.91	2.47	-12.00	-4.59		1.18
Low-High Volume Premium			1.36%			
Coefficient	0.0004	0.0226	-0.0626		0.0302	0.0024
t-stat	1.01	2.47	-12.02		4.15	1.30
Low-High Volume Premium			1.34%			
BK/MKT Quintile 4						
Coefficient	-0.0010	-0.0084	-0.0535			0.0059
t-stat	-3.09	-1.40	-10.27			3.31
Low-High Volume Premium			0.99%			
Coefficient	-0.0006	-0.0071	-0.0496	0.0192		0.0058
t-stat	-1.42	-1.18	-9.40	0.45		3.30
Low-High Volume Premium			0.92%			
Coefficient	-0.0008	-0.0078	-0.0523		0.0247	0.0058
t-stat	-2.43	-1.31	-10.04		9.00	3.30
Low-High Volume Premium			0.97%			
BK/MKT Quintile 5 (value)						
Coefficient	-0.0031	0.0006	-0.0519			0.0045
t-stat	-8.85	2.12	-9.92			2.92
Low-High Volume Premium			0.87%			
Coefficient	-0.0026	0.0006	-0.0493	0.0523		0.0042
t-stat	-5.37	2.07	-9.39	1.41		2.72
Low-High Volume Premium			0.83%			
Coefficient	-0.0027	0.0007	-0.0504		0.0100	0.0048
t-stat	-7.35	2.14	-9.66		2.63	3.09
Low-High Volume Premium			0.85%			

The sample includes stocks from NYSE and NASDAQ between 02/1993 and 12/2002. Weighted average slopes and associated t-statistics of monthly cross-sectional regressions of raw returns on turnover, illiquidity costs, book-to-market and firm size are calculated as in (5)-(7), for each book-to-market quintile. Low-High Volume Premium is the turnover coefficient times the difference between the 10th turnover percentile and the 90th turnover percentile for each book-to-market quintile. All stocks are included and book-to-market (BK/MKT) quintiles are defined monthly by NYSE breakpoints. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. XTURN is the average of share turnover for t-1 to t-3 demeaned each month by the average turnover for the firm's exchange. PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. ILLIQ(2) is the monthly illiquidity costs estimates for month t-1 as defined in (3). MOM6 is the is six-month cumulative holding period return to the end of month t-1.

TABLE 8B: Effects of Lagged Turnover and Illiquidity on Cross-Sectional Returns:
Regression Results by BK/MKT Quintiles - NASDAQ Stocks

	SIZE	BK/MKT	TURN	PQPSR	ILLIQ(2)	MOM6
BK/MKT Quintile 1 (glamour)						
Coefficient	0.0026	0.0125	-0.0289			-0.0039
t-stat	4.89	0.91	-9.72			-2.69
Low-High Volume Premium			1.28%			
Coefficient	0.0025	0.0087	-0.0287	-0.0466		-0.0038
t-stat	3.51	0.63	-9.44	-0.72		-2.69
Low-High Volume Premium			1.27%			
Coefficient	0.0027	0.0098	-0.0287		-0.0364	-0.0038
t-stat	4.72	0.71	-9.60		-2.36	-2.63
Low-High Volume Premium			1.27%			
BK/MKT Quintile 2						
Coefficient	0.0017	0.0631	-0.0281			0.0070
t-stat	2.83	4.12	-6.35			4.16
Low-High Volume Premium			1.01%			
Coefficient	-0.0004	0.0625	-0.0300	-0.2183		0.0065
t-stat	-0.48	4.08	-6.57	-3.35		3.88
Low-High Volume Premium			1.08%			
Coefficient	0.0014	0.0634	-0.0293		-0.0640	0.0068
t-stat	2.09	4.14	-6.58		-4.55	4.06
Low-High Volume Premium			1.05%			
BK/MKT Quintile 3						
Coefficient	0.0009	0.0284	-0.0609			0.0055
t-stat	1.74	2.42	-11.48			2.70
Low-High Volume Premium			1.71%			
Coefficient	-0.0009	0.0272	-0.0647	-0.2567		0.0050
t-stat	-1.19	2.32	-11.83	-4.53		2.44
Low-High Volume Premium			1.81%			
Coefficient	0.0006	0.0267	-0.0618		0.0211	0.0054
t-stat	1.03	2.28	-11.61		2.43	2.63
Low-High Volume Premium			1.73%			
BK/MKT Quintile 4						
Coefficient	-0.0018	-0.0002	-0.0627			0.0086
t-stat	-3.12	-0.03	-10.89			4.35
Low-High Volume Premium			1.35%			
Coefficient	-0.0023	0.0004	-0.0594	-0.1218		0.0086
t-stat	-2.89	0.05	-10.10	-2.44		4.38
Low-High Volume Premium			1.28%			
Coefficient	-0.0019	0.0002	-0.0613		0.0127	0.0084
t-stat	-3.10	0.02	-10.64		4.70	4.27
Low-High Volume Premium			1.32%			
BK/MKT Quintile 5 (value)						
Coefficient	-0.0048	0.0007	-0.0422			0.0026
t-stat	-7.39	2.17	-7.90			1.48
Low-High Volume Premium			0.80%			
Coefficient	-0.0051	0.0007	-0.0403	-0.0443		0.0024
t-stat	-6.18	2.20	-7.48	-0.99		1.40
Low-High Volume Premium			0.76%			
Coefficient	-0.0044	0.0007	-0.0413		0.0062	0.0029
t-stat	-6.58	2.12	-7.73		1.84	1.67
Low-High Volume Premium			0.78%			

The sample includes NASDAQ-listed stocks between 02/1993 and 12/2002. Book-to-market (BK/MKT) quintiles are defined monthly by NASDAQ breakpoints. Weighted average slopes and associated t-statistics of monthly cross-sectional regressions of raw returns on turnover, illiquidity costs, book-to-market and firm size are calculated as in (5)-(7), for each BK/MKT quintile. Low-High Volume Premium is the turnover coefficient times the difference between the 10th turnover percentile and the 90th turnover percentile for each BK/MKT quintile. SIZE is the logarithm of market capitalization at the end of month t-1. BK/MKT is the most recently available observation of book-to-market ratio at the end of month t-1. TURN is the average of share turnover for t-1 to t-3. PQSPR is the monthly average of the (daily) average proportional quoted spread at month t-1, considering all transactions that satisfy the data filters described in the text. ILLIQ(2) is the monthly illiquidity costs estimates for month t-1 as defined in (3). MOM6 is the is six-month cumulative holding period return to the end of month t-1.