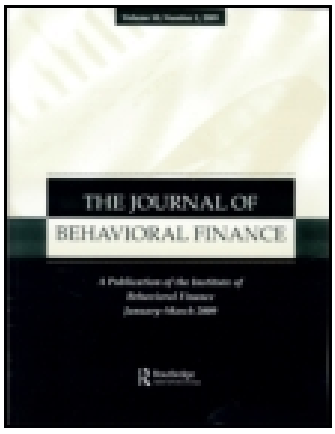


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# Investor Sentiment and Stock Market Liquidity

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# Investor Sentiment and Stock Market Liquidity

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Recent research on liquidity has reported that aggregate liquidity in the stock market varies over time, and evidence suggests that this variation affects stock returns. Although the importance of market liquidity in asset pricing has been well documented, little is known about what causes stock market liquidity to vary over time. This paper examines whether the time-series variation in stock market liquidity is related to investor sentiment. Using the liquidity measure developed by Amihud [2002] and two survey-based investor sentiment indices, I find that the stock market is more liquid when sentiment indices rise, that is, when investors are more bullish. Moreover, the Granger causality tests suggest that investor sentiment Granger-causes market liquidity. Further analyses show that market trading volume also increases when investor sentiment is higher. In addition, the finding that the market is more liquid when investor sentiment is higher still persists even after controlling for the effect of market trading volume. These results are consistent with the theoretical prediction that investor sentiment increases stock market liquidity.

***Keywords:*** Investor sentiment, Stock market liquidity, Trading volume, Institutional investors, Individual investors



## INTRODUCTION

A number of studies, including Hasbrouck and Seppi [2001], Huberman and Halka [2001], and Chordia et al. [2000, 2001], have documented that aggregate liquidity in the stock market varies over time. The importance of this variation has been demonstrated in several recent papers on asset pricing. For example, Amihud [2002] and Jones [2002] report that stock market liquidity predicts market returns, and Pastor and Stambaugh [2003] and Acharya and Pedersen [2005] show that the variation in market liquidity is an underlying risk factor in the stock market. In contrast to our knowledge of the importance of market liquidity fluctuations, we know little about what causes market liquidity to vary over time.

This paper studies whether the time-series variation in stock market liquidity is related to investor sentiment. Liquidity, as defined in Kyle's [1985] paper, is the inverse of the price sensitivity to order flows. Stocks are less liquid if the price impact caused by order flows is larger. Investor sentiment, as proposed by Baker and Wurgler [2006], is defined as investor optimism or pessimism about the future stock market. Higher investor sentiment indicates that investors are more bullish about the future performance of the stock market. The results in this paper show that the stock market is more liquid when investor sentiment is higher.

This finding that the market is more liquid when investor sentiment is higher is consistent with the theoretical prediction that investor sentiment increases stock market liquidity. Theoretical studies suggest that investor sentiment may have both direct and indirect effects on market liquidity. For the direct effects, higher investor sentiment may affect market liquidity through two channels: noise trading and irrational market makers. For the first channel, higher investor sentiment generates larger noise trading (De Long et al. [1990]), which in turn increases market liquidity (Kyle [1985]). For the second channel, Baker and Stein [2004] present a model in which there are more irrational market makers in the market when investor sentiment is higher. Since these market makers are assumed to underreact to the information contained in order flows, the price impact caused by order flows is lower, and therefore liquidity increases. The indirect effect that investor sentiment has

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on market liquidity is that higher sentiment may indicate that the overconfidence level in the market is higher and higher overconfidence increases stock liquidity (Odean [1998]).

Given the theoretical links between investor sentiment and liquidity, the current literature lacks empirical evidence on the relation between stock market liquidity and investor sentiment. The literature on liquidity focuses on how the liquidity variation affects stock returns. Fewer papers investigate the source of variations in the aggregate stock market liquidity. Two exceptions are studies by Chordia, Roll, and Subrahmanyam [2001] and Chordia, Sarkar, and Subrahmanyam [2005]. The former documents some market and macroeconomic factors affecting the daily percentage changes in market liquidity. The latter examines the intertemporal relations between market liquidity, returns, volatility, and order imbalances. Neither of these two papers, however, specifically considers the effect of investor sentiment on stock market liquidity. On the other hand, empirical studies on investor sentiment, from the earlier work by Lee, Shleifer, and Thaler [1991] until the recent study by Baker and Wurgler [2006], are centered on examining the relation between investor sentiment and stock prices. Although Baker and Stein [2004] propose a possible theoretical link between investor sentiment and market liquidity, they do not empirically test their model.

This paper contributes to the literature by providing the empirical evidence on how investor sentiment is related to stock market liquidity. The result that the stock market is more liquid when investor sentiment is higher is consistent with the theoretical prediction that investor sentiment increases stock market liquidity, either in a direct way by generating more noise trading or by increasing the proportion of irrational market makers, or in an indirect manner by indicating the higher overconfidence level in the market.

The empirical tests are designed in three steps. In the first step, I examine the relation between investor sentiment and market liquidity. I use the illiquidity measure developed by Amihud [2002] as a proxy for Kyle's concept of illiquidity. The market illiquidity is computed each month using all common stocks on the NYSE and AMEX during the period from 1976 to 2007. The investor sentiment measures are constructed using the Index of Investor Intelligence, a proxy for institutional investor sentiment, and the Index of the American Association of Individual Investors (AAII), a proxy for individual investor sentiment.

I begin the analysis by conducting the Granger causality tests on the Amihud market illiquidity measure and the two sentiment measures. The results indicate that investor sentiment Granger-causes market liquidity. I then estimate a time-series regression of the Amihud illiquidity measure on the two different investor sentiment measures. The results show that the market is more liquid when investor sentiment, either institutional or individual, is higher.

In the second step, I investigate the effect of investor sentiment on trading volume. The theoretical links between investor sentiment and market liquidity suggest that trading volume also increases when investor sentiment is higher. For the direct effect, higher investor sentiment increases market liquidity either by generating more noise trading or by bringing more irrational market makers to the market. Trading volume increases in both cases because noise trading is larger in the first case and informed traders trade more aggressively in the second case as a result of the lower price impact (Baker and Stein [2004]). As for the indirect effect, since investor sentiment is an indicator of overconfidence and overconfident investors trade more (Odean [1998]), we should also expect trading volume to increase when investor sentiment is higher.

The results from the time-series regressions of market turnover, a measure of market trading volume, on investor sentiment are consistent with the theoretical prediction—market trading volume is larger when investor sentiment is higher. More importantly, the finding that the market is more liquid when investor sentiment is higher still persists even after controlling for market trading volume. Since the Amihud measure has two components, trading volume in the denominator and price impact in the numerator, this result suggests that investor sentiment has two effects on market liquidity: increasing the trading volume and reducing the price impact.

In the third step, I examine whether short-sales constraints are important in the relation between investor sentiment and market liquidity. I begin the analysis by first investigating whether the variation in investor sentiment affects liquidity. Theoretical studies suggest that short-sales constraints are important if higher investor sentiment increases market liquidity in a direct way. If there are no short-sales constraints, noise trading or the proportions of irrational market makers would be large when sentiment is either very high or very low. In other words, the variation in sentiment would increase liquidity if short-sales constraints do not exist. To see whether this is true, I estimate the time-series regression of market liquidity on the standard deviation of investor sentiment. The results show that the variation in sentiment has no effect market liquidity. Market liquidity increases only when investor sentiment is higher.

The finding that market liquidity is not affected by the variation in investor sentiment does not necessary imply that sentiment increases market liquidity in a direct manner. The indirect link between investor sentiment and liquidity suggests that market liquidity also increases when higher sentiment indicates higher overconfidence levels. Moreover, compared to the direct effect, the indirect effect does not require that there are short-sales constraints because liquidity only increases when investors are overconfident. Therefore, testing whether short-sales constraints are

important may help us understand whether the direct effect that sentiment increases liquidity does exist.

Using the number of institutions holding the stock as the proxy for short-sales constraints, I find that short-sales constraints do take an important role in the relation between individual sentiment and market liquidity, which suggests the existence of the direct effect that individual sentiment may have on stock market liquidity. There is, however, no similar evidence for institutional sentiment.

The remainder of this paper is organized as follows. The second section reviews theoretical studies and discusses possible reasons that stock market liquidity may be related to investor sentiment. The third section describes the Amihud market illiquidity measure and the two investor sentiment measures. The fourth section presents the results of investor sentiment and stock market liquidity. The fifth section investigates the relation between investor sentiment and trading volume. The sixth section provides the evidence on whether short-sales constraints are important in the relation between market liquidity and investor sentiment. The seventh section summarizes the major findings in this paper.



## THE THEORETICAL LINKS BETWEEN INVESTOR SENTIMENT AND STOCK LIQUIDITY

I begin by reviewing theoretical studies on liquidity and investor sentiment in order to investigate whether it is possible in theory that these two are related. Both liquidity and investor sentiment have various definitions in the literature. In this paper, I use Kyle's [1985] definition of liquidity, namely, the inverse of the price sensitivity to order flows. For investor sentiment, I adopt one of the definitions proposed by Baker and Wurgler [2006]: optimism or pessimism about the future stock market performance.

The theoretical studies in behavioral finance and in market microstructure suggest that investor sentiment and liquidity are related. Moreover, it is highly possible that higher investor sentiment increases liquidity. To understand how investor sentiment may influence liquidity, we need to first examine how liquidity is related to the behavior of various market participants because sentiment may affect liquidity by influencing the behavior of these participants. In Kyle's [1985] trading model, there are three types of market participants: one insider, market makers, and noise traders. The insider submits orders based on the private information he or she receives. Noise traders do not have private information and trade for other reasons. The market makers, when receiving the orders from the insider and noise traders, set an efficient price at which they trade to clear the market. Since the market makers cannot distinguish between the orders from the insider and the orders from noise traders, they adopt a linear pricing rule: $P = P0 + \lambda^*y$, where P0 is the mean of the intrinsic value, and y is the aggregate net order flow from the insider and the noise traders. Kyle's concept of illiquidity refers to $\lambda$, which measures the impact on price caused by the order flow. From this model, we can see that the behavior of three types of participants would affect liquidity: noise traders, the insider, and market makers. If one or all of them are influenced by investor sentiment, then market liquidity would be affected accordingly.

Behavioral finance literature suggests that investor sentiment may have both direct and indirect effects on liquidity. Investor sentiment directly affects market liquidity through two channels. The first channel is that higher investor sentiment leads to larger noise trading that, in turn, increases liquidity. This potential link between liquidity and investor sentiment is implied in two theoretical studies. First, in Kyle's [1985] model, larger noise trading would lead to higher liquidity. This is because when noise trading is larger, market makers believe that the proportions of insider trading in the aggregate order flow are lower. Accordingly, these market makers would adjust the price in a smaller amount, which means the price impact caused by the order flow is lower and thus liquidity increases. Second, in the model proposed by DeLong et al. [1990], higher sentiment generates more noise trading because investor sentiment indicates that noise traders misperceive the future market prices. Note that DeLong et al.'s model allows noise traders to short sell so they trade aggressively if their sentiment is high (bullish) or low (bearish); that is, they overvalue or undervalue the stock price. In the real world, short selling is costly and sometime impossible. If there are short-sales constraints, noise traders can only trade when their sentiment is high. The higher their sentiment is, the more aggressively they trade. Therefore, if we combine the Kyle and DeLong et al.'s models plus short-sales constraints, we can see that higher investor sentiment generates larger noise trading that, in turn, increases market liquidity.

The second channel through which investor sentiment directly increases stock market liquidity is that higher investor sentiment indicates that there are more irrational market makers. Baker and Stein [2004] propose a model to illustrate this process. Similar to Kyle's [1985] setup, there are liquidity traders, market makers, and one insider in Baker and Stein's model [2004]. The difference in their model is that there are two types of market makers—rational and irrational. The rational market makers are assumed to be able to correctly infer the insider's information from the order flow while the irrational market makers are overconfident and so they underreact to the insider's information. Because of this underreaction, the price impact caused by the insider is smaller if the proportions of irrational market makers are higher. Given the short-sale constraints, these irrational market makers can only be present in the market

when their initial sentiment is higher, namely they overvalue the intrinsic value of the stock. Higher investor sentiment leads to larger proportions of irrational market makers and a lower price impact, and thus market liquidity increases.

Investor sentiment also has an indirect effect on liquidity by indicating that investors are more overconfident. Current research has established that the market is more liquid when investors are overconfident. For example, Odeon's [1998] model shows that the market is more liquid when either the insiders or the market makers are overconfident.

Studies on investor psychology show that investor sentiment and overconfidence are two important judgment biases that affect investors' decisions (Kahneman and Riepe [1998]). Optimism and overconfidence are related in two aspects. First, optimistic persons are more likely to be overconfident. In psychology literature, overconfidence has many manifestations, and one of them is excessively optimism: People expect good things to happen and they are optimistic about pure chance events (Marks [1951], Irwin [1953]). Given that optimism is one aspect of overconfidence, it is possible that optimistic investors are also overconfident. When investors are more optimistic, they tend to be more overconfident.

Second, higher sentiment or optimism may come from past success, and past success also generates overconfidence. For the former, Fisher and Statman [2000] find that a higher market return in the previous month makes investors bullish. For the latter, Gervais and Odean [2001] argue that when market performed well in the past, the aggregate overconfidence is higher because the majority of investors gain in a bull market and then tend to attribute their success to their own ability. The results from these two studies indicate that higher market returns in the past make investors optimistic and, at the same time, overconfident. In brief, the evidence from current literature suggests that investor sentiment and overconfidence are related. Higher sentiment indicates investors are more overconfident, and overconfidence increases market liquidity.

In summary, the theoretical studies suggest that investor sentiment increases stock market liquidity in both direct and indirect ways. For the direct way, higher investor sentiment may generate more noise trading or induce more irrational market makers, and therefore market liquidity increases. For the indirect way, higher investor sentiment may signal that investors are more overconfident and liquidity increases accordingly.

It is possible that the causality goes the other way around, namely market liquidity increases investor sentiment, although there are neither theoretical nor empirical studies to support this hypothesis. In the following empirical analysis sections, I will first show whether investor sentiment and liquidity are related, and then examine the causality between these two.

## MARKET LIQUIDITY AND INVESTOR SENTIMENT MEASURES

### The Market Liquidity Measure

The liquidity measure used in this paper is proposed by Amihud [2002]. This measure is essentially an illiquidity measure that follows Kyle's [1985] concept of illiquidity—the price response to order flows. It has been used in several recent studies on liquidity.[1] Studies by Amihud [2002], Hasbrouck [2009], and Goyenko, Holden, and Trzcinka [2009] all demonstrate that the Amihud illiquidity measure is highly correlated with the TAQ-based price impact measures.

This measure is computed as the absolute price change per dollar of daily trading volume for each stock each day, $\frac{|R^i_{td}|}{\$VOL^i_{td}}$, where $R^i_{td}$ is stock i's return on day d of month t and $\$VOL^i_{td}$ is the same day dollar trading volume (measured in millions of dollars) of this stock. The monthly illiquidity measure for each stock is computed by averaging the daily measure within each month, $\frac{1}{D^i_t}\sum_{d=1}^{D^i_t}\frac{|R^i_{td}|}{\$VOL^i_{td}}$, where$D^i_t$ is the number of days in month t for which data are available for stock i. It assesses the average daily price impact caused by \$1 million trading volume for stock i in each month. The market illiquidity is calculated as the cross-sectional equal-weighted or value-weighted average of individual stock illiquidity in that month.[2] The market capitalization of each stock at the beginning of the year is used as the weight to compute value-weighted average. I use all common stocks on the NYSE and AMEX to compute the monthly market illiquidity measure.[3] To adjust the inflation effect on the denominator, I scale the market illiquidity measure using Consumer Price Index (all items).[4] Following Amihud [2002], I use the logarithmic transformation of market illiquidity.

Figure 1 presents the time series pattern of the logarithm of equal-weighted market illiquidity from January 1976 to December 2007.[5] I consider the sample period after 1975 in order to avoid any influences that the fixed commission may have on the market liquidity.[6] As shown in the figure, the stock market experiences a significant decrease in illiquidity, that is, becomes more liquid, over the sample period. This decreasing pattern in market illiquidity is consistent with the recent findings in the literature that the stock market has become more liquid for the past two decades. The clear downward trend measure also implies that market illiquidity is not a stationary series over time. Figure 2 plots the first differences, namely monthly changes, of the equal-weighted logarithm of market illiquidity. I conduct the augmented Dickey-Fuller tests for stationarity and the results show that the first differences series is stationary.

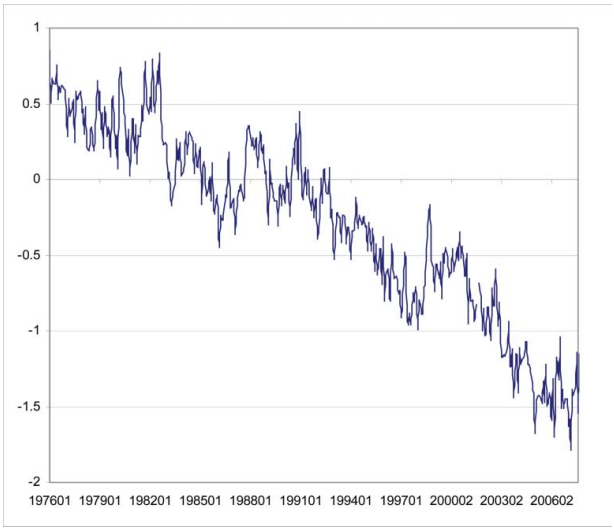


FIGURE 1 Logarithm of Equal-weighted Market Illiquidity. Note. For each stock each day, illiquidity is computed as the absolute price change per million dollar of daily trading volume. The monthly illiquidity measure for each stock is computed by averaging the daily measure within each month. The market illiquidity is defined as a cross-sectional equal-weighted average of individual stock illiquidity in that month. I compute monthly market illiquidity measure using all common stocks on the NYSE and AMEX from January 1976 to December 2007. To adjust the effect of inflation on the denominator, I use Consumer Price Index (all items) to scale the market illiquidity measure. This figure presents the time-series pattern of the logarithm of equal-weighted market illiquidity.

Thus, I use the first differences of market illiquidity in the regression analyses in the later sections.

Table 1 reports the means and standard deviations of the levels (Panel A) and the first differences (Panel B) of the logarithm of equal-weighted market illiquidity. In Panel A, the mean of market illiquidity during the sample period is −0.2954. This number indicates that, on average, the price impact caused by one million dollar trading volume is about $e^{-0.2954}$, which equals 74.4%. Panel B shows that the average of monthly changes in market illiquidity is −0.0061 and the standard deviation is 0.1749.

Since the Amihud illiquidity measure is computed using trading volume, one may expect that the illiquidity measure is instead a proxy for trading volume given the high negative correlation between market illiquidity and market turnover (−0.9255 as shown in Panel A of Table 1). However, since both the market illiquidity and market turnover data series are trending over time, the high correlation between the two series may partially come from the time trend. When removing the trend from both data series, the correlation between the detrended market illiquidity and the detrended market turnover is only −0.4974. In addition, to minimize the trending and serial correlation problems in the data, I use changes instead of the levels of the variables in the regression analysis. The low correlation between changes in market illiquidity and changes in market turnover (−0.1405, as reported in Panel B of Table 1) indicates that the information in the Amihud market illiquidity measure is not subsumed by that in market turnover. Moreover,

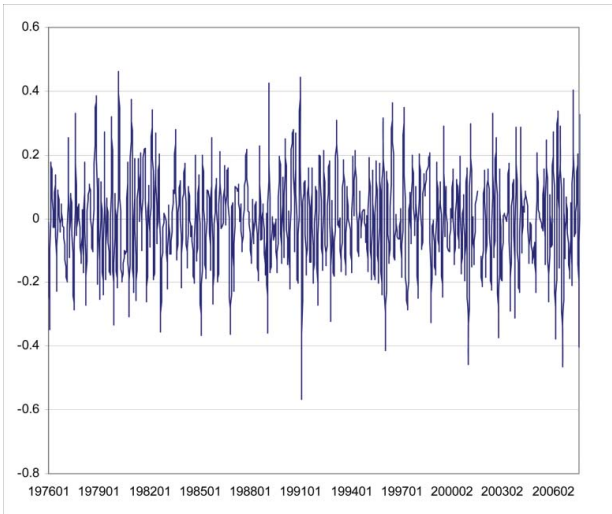


FIGURE 2 Monthly Changes in Logarithm of Equal-Weighted Market Illiquidity. Note. This figure presents the time-series pattern of the monthly changes in the logarithm of equal-weighted market illiquidity. The equal-weighted market illiquidity is defined in Figure 1.

TABLE 1
Descriptive Statistics—Market Illiquidity, Turnover, and Investor Sentiment

Panel A Illiquidity, Turnover, and Investor Sentiment

| | Illiquidity | Turnover | Institution (%) | Individual (%) |
|---|---|---|---|---|
| MEAN | −0.2954 | −1.2797 | 13.1216 | 10.4457 |
| STD | 0.6185 | 0.5162 | 18.6606 | 15.1664 |
| Illiquidity | 1 | | | |
| Turnover | −0.9255 | 1 | | |
| Institution | −0.3582 | 0.3380 | 1 | |
| Individual | −0.2831 | 0.1957 | 0.5277 | 1 |

Panel B Changes in Illiquidity, Turnover, and Investor Sentiment

| | ΔIlliquidity | ΔTurnover | Δinstitution (%) | Δindividual (%) |
|---|---|---|---|---|
| MEAN | −0.0061 | 0.0057 | −0.0057 | −0.1156 |
| STD | 0.1749 | 0.1305 | 11.2470 | 13.0875 |
| ΔIlliquidity | 1 | | | |
| ΔTurnover | −0.1405 | 1 | | |
| Δinstitution | −0.3526 | 0.3866 | 1 | |
| Δindividual | −0.3012 | 0.1326 | 0.4890 | 1 |

*Note*. This table reports the means and standard deviations of monthly levels (Panel A) of or monthly changes (Panel B) in market illiquidity, market turnover, and investor sentiment measures. The bottom part of each panel contains the correlations between the levels or the monthly changes. Illiquidity (turnover) is the logarithm of an equal-weighted market illiquidity (turnover) measure. Institution (Individual) is the institutional (individual) sentiment index that is computed as the difference between Bullish Consensus and Bearish Consensus of the Investors Intelligence Index (the American Individual Investor Index). The sample period is from January 1976 to December 2007 except for individual sentiment that begins in July 1987.

the next section examines the effect of investor sentiment on market illiquidity after controlling for market turnover.

### Investor Sentiment Measures

The investor sentiment measures include the institutional investor sentiment index and the individual investor sentiment index, both of which directly reflect investor expectation on the future performance of the stock market.[7] The institutional investor sentiment index is constructed from the Investor's Intelligence. Each week, about 150 newsletters are read and marked as bullish, bearish, or neutral based on the expectation of future market movements. I use the difference between the percentages of bullish and bearish letters as a sentiment measure. Since the authors of these newsletters are generally market professionals, I treat this measure as a proxy for institutional investor sentiment. The individual investor sentiment index is from the survey conducted by the American Association of Individual Investors. The association polls a random sample of its members each week and asks participants where they think the stock market will be in six months: up, down, or the same. The responses are labeled as bullish, bearish, or neutral, respectively. I use the difference between the percentages of bullish and bearish responses as a sentiment measure. Since the survey participants are individual investors, I treat this measure as a proxy for individual investor sentiment.

The bullish and bearish consensus data for both indices are published in Barron's every week. I first compute the difference between the percentages of bullish and bearish responses (bull-bear spread) each week and then average these spreads within the month to get monthly average bull-bear spreads. The institutional sentiment index is available from December 1969. To be consistent with the market illiquidity series, I also consider the sample period from January 1976 to December 2007. The data of individual sentiment index is available from July 1987 to December 2007.

Figure 3 plots the institutional and individual bull-bear spread series (in percentage). As shown in the figure, institutional bull-bear spread (the solid line) is in the range of −30% to 40% in most of the sample period. The individual bull-bear spread series (the broken line) starts from July 1987 and its pattern of variations over time is very similar to that of institutional sentiment series.

Table 1 reports the means and standard deviations of the levels (Panel A) and the first differences (Panel B) of institutional sentiment and individual sentiment indices. The numbers are in percentages. As shown in the table, the means of institutional and individual bull-bear spreads are 13.12% and 10.45% respectively. These two positive numbers suggest that on average more investors are bullish about the market during the sample period.

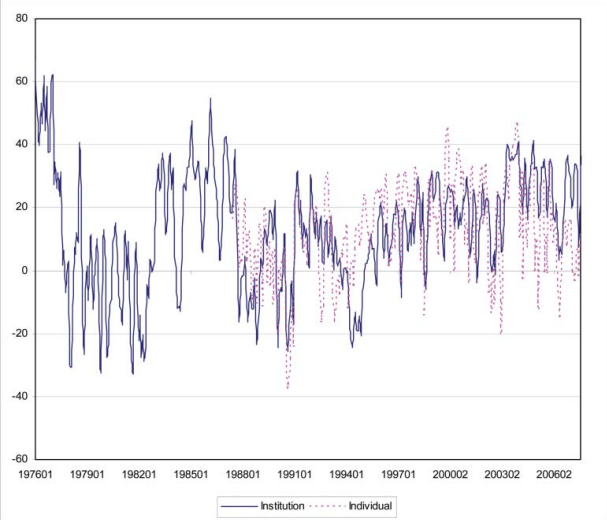


FIGURE 3 Institutional Sentiment and Individual Sentiment. Note. Institution (Individual) is the institutional (individual) sentiment index that is computed as the difference between Bullish Consensus and Bearish Consensus of the Investors Intelligence Index (the American Individual Investor Index). The sample period is from January 1976 to December 2007 for institutional sentiment and from July 1987 to December 2007 for individual sentiment. This figure plots monthly values (in percentage) of institutional sentiment and individual sentiment over the sample period.

## INVESTOR SENTIMENT AND MARKET LIQUIDITY

I begin the empirical analysis by examining whether investor sentiment and stock market liquidity are related. The tests are conducted in three steps. First, I show stock market liquidity is correlated with investor sentiment. Second, I conduct Granger causality tests to determine whether investor sentiment causes liquidity or liquidity affects investor sentiment. Third, I use time-series regressions to investigate whether investor sentiment influences stock market liquidity after controlling for other factors.

### Preliminary Results

The bottom part in each panel of Table 1 reports the contemporaneous correlations between illiquidity and the two sentiment measures (levels in Panel A and changes in Panel B). The results show that market illiquidity and the two sentiment measures are negatively correlated. Specifically, as reported in Panel A, the correlation is −0.3582 between institutional sentiment and illiquidity and −0.2831 between individual sentiment and illiquidity. The correlations between changes of these variables (Panel B) are also negative and similar in magnitude. These negative correlations between sentiment and illiquidity suggest that the stock market is more liquid (less illiquid) when sentiment is higher. Another finding in Table 1 is that both sentiment measures are positively correlated. The sentiment level

correlation and the change correlation are 0.5277 (Panel A) and 0.4890 (Panel B), respectively.

I next compare the average levels of market illiquidity in high and low sentiment periods. If the market is more liquid when investor sentiment is higher, then the average value of the Amihud illiquidity measure in high sentiment periods would be lower than that in low sentiment periods. To compute mean values of illiquidity in high and low sentiment periods, I first rank all the available months by the sentiment values and classify the whole sample period into two equal-length subperiods: high sentiment subperiod, which includes those months with sentiment values higher than the median sentiment value over the whole sample period, and low sentiment subperiod, which has months with sentiment values lower than the median. I classify the high and low sentiment subperiods for each investor sentiment measure separately. Then I compute the means of the market illiquidity measures in these two subperiods and compare their differences.

The results are reported in Table 2. For each sentiment measure, the first two rows report the average (equal-weighted or value-weighted) of market illiquidity in low and high sentiment subperiods. The third and the fourth rows report the differences in illiquidity between high and low sentiment periods and the t-statistics from the tests with the null hypotheses that the mean illiquidity values in the two sub-periods are equal. For ease of interpretation, I use the raw values of market illiquidity without the logarithmic transformation.

As shown in Table 2, the average values of market illiquidity in low sentiment subperiods are larger than those in high sentiment subperiods and their differences are statistically significant. This result holds for both institutional sentiment and individual sentiment. For example, the equal-weighted market illiquidity is 1.0575 in high institutional sentiment subperiod and 0.7122 in low sentiment subperiod. Their difference (−0.3453) is statistically significantly at the 1% level (t = −7.37). The results in Table 2 suggest that investor sentiment is correlated with stock market liquidity. The market is significantly more liquid in high sentiment periods than it is in low sentiment periods.

## Granger Causality Tests

The preliminary results in Tables 1 and 2 reveal that the market is more liquid when investor sentiment is higher. However, the direction of the causality is still not clear. It is possible that higher investor sentiment causes a more liquid market, or higher liquidity leads to higher investor sentiment, or both directions may work at the same time. To further determine the direction of the causality, I conduct Granger causality tests on the monthly changes in the logarithm of illiquidity and the monthly changes in sentiment.[8] Table 3 reports the Chi-square statistics from Granger causality tests. The null hypothesis is that the variable in Group 2 does not Granger-cause the variable Group 1. Panel A shows the results using equal-weighted illiquidity in the Granger causality tests, while panel B contains results for value-weighted illiquidity.[9]

The results in Table 3 show that investor sentiment Granger-causes illiquidity but illiquidity does not Granger-cause investor sentiment. As reported in the table, for institutional sentiment, the Chi-square statistics are 38.15 (Panel A) for equal-weighted illiquidity and 17.21 (Panel B) for value-weighted illiquidity, both of which are significant at the 1% level. The results suggest that the null hypothesis that institutional sentiment does not Granger-cause illiquidity is rejected. The reverse is not true, however. The Chi-square statistics in both panels (5.45 and 6.68) are not significant, indicating that the null hypothesis that illiquidity

TABLE 2
Market Illiquidity in High and Low Sentiment Subperiods

| Sentiment | Subperiod | | Illiquidity (EW) | Illiquidity (VW) | Turnover (EW) | Turnover (VW) |
|---|---|---|---|---|---|---|
| | Low | Mean | 1.0575 | 0.0713 | 0.2517 | 0.2333 |
| Institution | High | Mean | 0.7122 | 0.0387 | 0.3877 | 0.3369 |
| | High-Low | Mean | −0.3453 | −0.0326 | 0.1359 | 0.1036 |
| | | t-stat | −7.37 | −7.19 | 7.65 | 7.38 |
| | Low | Mean | 0.7013 | 0.0319 | 0.3823 | 0.3390 |
| Individual | High | Mean | 0.5328 | 0.0205 | 0.4046 | 0.3574 |
| | High-Low | Mean | −0.1685 | −0.0114 | 0.0223 | 0.0184 |
| | | t-stat | −4.44 | −5.03 | 0.90 | 1.03 |

*Note*. For each investor sentiment measure, I rank all the available months by the sentiment values and classify the whole sample period into two equal-length subperiods: high sentiment subperiod, which includes those months with sentiment values higher than the median sentiment value over the whole sample period, and low sentiment subperiod, which has months with sentiment values lower than the median. Then I compute the average of monthly market illiquidity or turnover in these two periods and compare their differences. Monthly market illiquidity or turnover is an equal-weighted or a value-weighted average of individual stock illiquidity or turnover within a month. I consider the raw values of market illiquidity with no logarithmic transformation. For each sentiment measure, the third and the fourth rows report the differences in illiquidity or turnover between the two subperiods and the t-statistics from the tests with the null hypotheses that the mean illiquidity or turnover values in the two sub-periods are equal. Institutional sentiment is available from January 1976 to December 2007. Individual sentiment is from July 1987 to December 2007.

does not Granger-cause institutional sentiment cannot be rejected. The results are similar for individual sentiment. Individual investor sentiment Granger-causes illiquidity but illiquidity does not Granger-cause individual sentiment. Overall, the evidence in Table 3 is consistent with the theoretical prediction that investor sentiment increases stock market liquidity.[10]

Table 3 also reports the statistics for the causality tests between institutional sentiment and individual sentiment. The results show that the causality runs in two directions. Institutional sentiment Granger-causes individual sentiment and individual sentiment also Granger-causes institutional sentiment.

## Time-Series Regressions

In this section, I use time-series regression analyses to examine how investor sentiment affects market liquidity. The dependent variable is the monthly change in the logarithm of equal-weighted market illiquidity and the independent variable is the contemporaneous monthly changes in the sentiment indices.[11] The regressions also include the following control variables that have been found to affect market liquidity by Chordia, Roll, and Subrahmanyam [2001].

ShortRate is the monthly change in the federal funds rate, which is one type of the costs of trading. A higher rate would decrease trading in the stock market, and thus reduce market liquidity. TermSpread is the monthly change in the term spread, which is the difference between the yield on a constant maturity 10-year Treasury bond and the federal funds rate. This variable affects investors' decision on wealth allocation between equity and debt. A larger term spread indicates that investors have tendency to invest more in bond markets than in stock markets. Therefore, when the term spread increases, stock market liquidity would decrease. DefaultSpread is the monthly change in the default spread, which is the difference between the yields on Moody's Baa or better corporate bond yield index and the yield on a 10-year constant maturity Treasury bond. Higher default spread reduces market liquidity because it increases the perceived risk of holding stocks, which, in turn, decreases investors' incentive to participate in the stock market.

I also include three variables of recent market conditions. MA3MKT+ is the past 3-month CRSP equal-weighted index return if it is positive and zero otherwise. MA3MKT− is the past three-month CRSP equal-weighted index return if it is negative and zero otherwise. These two variables intend to capture the asymmetric effects of the recent market trend on the current market liquidity. MA3|MKT| is the past 3-month average of the absolute value of CRSP equal-weighted index returns. This variable is a proxy for market volatility, which reflects the risk of trading. Higher market volatility in the past may decrease investor incentive to trade in the current month.

In case sentiment may merely capture the effects of macroeconomic variables on market liquidity, I also include three macro-economic variables. Consumer Price Index (CPI) is the monthly change in the logarithm of consumer price index. Unemploy is the monthly change in unemployment rate. DispIncome is the monthly change in the logarithm of disposable personal income. When the inflation rate and unemployment rate are higher and when investors have less disposable income, the market would become less liquid because investors have less incentive to trade.

Figure 2 shows that the first difference of market illiquidity displays a clear seasonal pattern. To capture this regularity, I include 11 monthly dummies in the regressions, one for each month from February to December.

There are two reasons that I choose to use changes instead of levels of the variable in the regression. First, the autocorrelation in market illiquidity is very high. Moreover, it is trended over time. As suggested by Wooldridge [2002], taking first differences would minimize the high serial correlation and trending problems in the data. Second, some control variables have unit roots that make it difficult to use levels in the regressions.

I choose two methods to estimate the coefficients. The first method is the OLS method and the autocorrelations in the error terms are corrected using a Newey and West [1987] correction with 12 lags. The second method is the maximum likelihood estimation method with AR(2) errors. The results from the two methods are essentially the same. Therefore, I only report in Table 4 the OLS coefficients with a Newey-West correction. Since the institutional sentiment index is available for a longer period than the

TABLE 3
Granger Causality Tests

Panel A

| | | | Group 1 | |
|---|---|---|---|---|
| | | Illiquidity (EW) | Institution | Individual |
| | Illiquidity (EW) | | 5.45 | 6.78 |
| Group 2 | Institution | 38.15*** | | 13.36 |
| | Individual | 14.69** | 18.78*** | |

Panel B

| | | | Group 1 | |
|---|---|---|---|---|
| | | Illiquidity (VW) | Institution | Individual |
| | Illiquidity (VW) | | 6.68 | 10.62 |
| Group 2 | Institution | 17.21*** | | 13.36** |
| | Individual | 11.86* | 18.78*** | |

*Note*. This table presents the Chi-square statistics from the Granger causality tests on monthly changes in the logarithm of equal-weighted (value-weighted) market illiquidity and monthly changes in sentiment. The null hypothesis is that the variable in Group 2 does not Granger-cause the variable Group 1. *** indicates statistical significance at the 1% level; ** at the 5% level; * at the 10% level.

TABLE 4
Investor Sentiment and Market Illiquidity

Panel A: Institutional Investor Sentiment (Jan 1976 to Dec 2007)

| | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat |
|---|---|---|---|---|---|---|---|---|
| Institution | | | −0.5583 | −8.37 | | | −0.5462 | −7.70 |
| ShortRate | | | | | 13.3852 | 4.61 | 5.8694 | 1.72 |
| TermSpread | | | | | 12.2694 | 3.78 | 5.1045 | 1.33 |
| DefaultSpread | | | | | 22.9228 | 3.83 | 14.9779 | 2.23 |
| MA3MKT+ | | | | | 0.3886 | 0.70 | −0.0033 | −0.01 |
| MA3MKT- | | | | | −1.7022 | −2.08 | −1.6590 | −2.22 |
| MA3\|MKT\| | | | | | −0.6808 | −1.08 | −0.3975 | −0.66 |
| CPI | | | | | 0.6206 | 0.32 | −0.5482 | −0.31 |
| Unemploy | | | | | 0.3789 | 0.09 | −1.6141 | −0.45 |
| DispIncome | | | | | 0.1745 | 0.17 | 0.8617 | 0.81 |
| February | −0.2542 | −6.86 | −0.2753 | −7.38 | −0.2455 | −6.54 | −0.2623 | −7.24 |
| March | 0.1320 | 3.90 | 0.1243 | 3.40 | 0.1145 | 3.41 | 0.1171 | 3.35 |
| April | −0.0844 | −2.36 | −0.1038 | −3.08 | −0.0962 | −2.76 | −0.1053 | −3.35 |
| May | −0.0069 | −0.22 | −0.0197 | −0.58 | −0.0091 | −0.29 | −0.0204 | −0.61 |
| June | −0.0507 | −1.25 | −0.0469 | −1.16 | −0.0516 | −1.28 | −0.0482 | −1.17 |
| July | −0.0346 | −1.13 | −0.0411 | −1.35 | −0.0370 | −1.21 | −0.0443 | −1.47 |
| August | 0.0268 | 0.75 | 0.0010 | 0.03 | 0.0199 | 0.54 | −0.0052 | −0.14 |
| September | −0.1387 | −3.88 | −0.1544 | −4.16 | −0.1535 | −4.43 | −0.1682 | −4.82 |
| October | 0.0823 | 3.04 | 0.0597 | 1.77 | 0.0575 | 2.13 | 0.0360 | 1.08 |
| November | −0.1278 | −3.40 | −0.1200 | −3.55 | −0.1371 | −3.64 | −0.1379 | −3.97 |
| December | −0.0849 | −2.05 | −0.0642 | −1.58 | −0.0946 | −2.30 | −0.0836 | −2.10 |
| Intercept | 0.0391 | 1.79 | 0.0474 | 1.88 | 0.0522 | 1.99 | 0.0567 | 2.13 |
| Adjusted $R^2$ | 0.3042 | | 0.4284 | | 0.3411 | | 0.4485 | |

Panel B: Institutional and Individual Investor Sentiment (Aug 1987 to Dec 2007)

| | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Institution | | | −0.6771 | −7.56 | | | | | −0.6985 | −6.84 | | | −0.5623 | −4.85 |
| Individual | | | | | −0.3819 | −5.45 | | | | | −0.3922 | −5.57 | −0.2124 | −2.63 |
| ShortRate | | | | | | | 8.5848 | 1.39 | −3.6871 | −0.68 | 2.6100 | 0.52 | −4.5298 | −0.86 |
| TermSpread | | | | | | | 2.5842 | 0.61 | −6.5042 | −1.80 | −0.6612 | −0.20 | −6.4895 | −1.90 |
| DefaultSpread | | | | | | | 18.2300 | 2.44 | −3.8046 | −0.46 | 7.0106 | 0.92 | −5.5837 | −0.65 |
| MA3MKT+ | | | | | | | 0.0330 | 0.05 | −0.1650 | −0.28 | −0.4088 | −0.64 | −0.3657 | −0.65 |
| MA3MKT- | | | | | | | −0.8200 | −0.74 | −1.1274 | −1.37 | −1.1276 | −1.29 | −1.2341 | −1.61 |
| MA3\|MKT\| | | | | | | | −0.0858 | −0.09 | −0.1860 | −0.25 | −0.2223 | −0.29 | −0.2404 | −0.34 |
| CPI | | | | | | | 3.9962 | 1.24 | 0.3847 | 0.12 | 1.1467 | 0.38 | −0.4542 | −0.14 |
| Unemploy | | | | | | | 1.0605 | 0.13 | −0.4933 | −0.07 | 1.2395 | 0.17 | −0.0933 | −0.01 |
| DispIncome | | | | | | | 0.8938 | 0.64 | 1.2748 | 0.86 | 1.5698 | 1.51 | 1.5666 | 1.22 |
| February | −0.2594 | −4.68 | −0.2651 | −5.15 | −0.2564 | −5.07 | −0.2555 | −4.65 | −0.2636 | −5.08 | −0.2502 | −5.10 | −0.2591 | −5.24 |
| March | 0.1369 | 2.99 | 0.1332 | 2.69 | 0.1280 | 2.81 | 0.1266 | 2.64 | 0.1412 | 2.87 | 0.1306 | 2.97 | 0.1405 | 2.98 |
| April | −0.0698 | −1.44 | −0.0897 | −1.92 | −0.0740 | −1.47 | −0.0729 | −1.53 | −0.0783 | −1.83 | −0.0685 | −1.50 | −0.0748 | −1.77 |
| May | 0.0026 | 0.06 | 0.0032 | 0.07 | 0.0115 | 0.26 | 0.0046 | 0.10 | 0.0061 | 0.12 | 0.0110 | 0.26 | 0.0093 | 0.19 |
| June | −0.0585 | −1.02 | −0.0468 | −0.82 | −0.0563 | −0.95 | −0.0624 | −1.05 | −0.0500 | −0.83 | −0.0600 | −1.03 | −0.0511 | −0.86 |
| July | −0.0251 | −0.57 | −0.0311 | −0.67 | −0.0282 | −0.62 | −0.0244 | −0.56 | −0.0313 | −0.65 | −0.0313 | −0.73 | −0.0337 | −0.72 |
| August | 0.0370 | 0.81 | 0.0070 | 0.14 | 0.0290 | 0.63 | 0.0311 | 0.64 | 0.0036 | 0.07 | 0.0230 | 0.49 | 0.0046 | 0.09 |
| September | −0.1415 | −2.83 | −0.1521 | −3.12 | −0.1332 | −2.61 | −0.1650 | −3.33 | −0.1644 | −3.39 | −0.1519 | −3.11 | −0.1574 | −3.25 |
| October | 0.0902 | 2.37 | 0.0888 | 1.96 | 0.1076 | 2.75 | 0.0799 | 1.95 | 0.0823 | 1.67 | 0.0947 | 2.43 | 0.0899 | 1.94 |
| November | −0.1329 | −2.94 | −0.1175 | −2.84 | −0.1166 | −2.82 | −0.1254 | −2.75 | −0.1265 | −2.81 | −0.1258 | −3.01 | −0.1265 | −2.90 |
| December | −0.0697 | −1.25 | −0.0422 | −0.75 | −0.0666 | −1.25 | −0.0647 | −1.19 | −0.0545 | −0.92 | −0.0817 | −1.60 | −0.0657 | −1.18 |
| Intercept | 0.0351 | 1.06 | 0.0373 | 1.01 | 0.0314 | 0.92 | 0.0221 | 0.60 | 0.0334 | 0.85 | 0.0331 | 0.99 | 0.0371 | 1.02 |
| Adjusted $R^2$ | 0.3088 | | 0.4402 | | 0.3882 | | 0.3093 | | 0.4359 | | 0.3882 | | 0.4526 | |

*Note*. In the contemporaneous time-series regression, the dependent variable is the monthly change in the logarithm of equal-weighted market illiquidity. The independent variables are as follows. Institution (Individual) is the monthly change in the institutional (individual) sentiment measure defined in Table 1. ShortRate is the monthly change in the federal funds rate. TermSpread is the monthly change in the difference between the yield on a constant maturity 10-year Treasury bond and the federal funds rate. DefaultSpread is the monthly change in the difference between the yield on Moody's Baa or better corporate bond yield index and the yield on a 10-year constant maturity Treasury bond. CPI is the monthly change in the logarithm of Consumer Price Index. Unemploy is the monthly change in the unemployment rate. DispIncome is the monthly change in the logarithm of the disposable personal income. MA3MKT+ is the past three-month CRSP equal-weighted index returns if it is positive and zero otherwise. MA3MKT− is the past three-month CRSP equal-weighted index returns if it is negative and zero otherwise. MA3|MKT| is the past 3-month average of the absolute values of the CRSP equal-weighted index returns. February to December provided the 11 monthly dummy variables. The coefficients are estimated using OLS and the autocorrelations in the error terms are corrected using a Newey and West [1987] correction with 12 lags. Panel A reports the results of institutional sentiment in the whole sample period from January 1976 to December 2007. Panel B reports the results of institutional sentiment and individual sentiment in the period from August 1987 to December 2007.

individual sentiment index, I report in Panel A the results for the institutional sentiment index in the period from January 1976 to December 2007 and in Panel B the results for the institutional and individual sentiment indices when both series are available from August 1987 to December 2007.

Panel A of Table 4 reports the estimated coefficients and the t-statistics from four regressions. In the first regression, when only the intercept and monthly dummies are present as independent variables, the results show that market illiquidity has a clear seasonal pattern: The coefficients are significantly negative for February, April, September, November, and December dummies, which suggests a more liquid (i.e., lower illiquidity values) market in these months.[12] The significantly positive coefficients of the March and October dummies imply that the market is less liquid (i.e., higher illiquidity values) in these two months.

The results in the second regression, in which the institutional investor sentiment is added as an independent variable, show that the coefficient of the institutional sentiment index is negative (−0.5583) and significant (t = −8.37). Moreover, compared to the first regression with only monthly dummies and intercepts, adding institutional sentiment increases the adjusted $R^2$ from 0.30 to 0.43 (see the last row of Panel A).

The third regression includes both control variables and monthly dummies as independent variables. Consistent with the findings in Chordia, Roll, and Subrahmanyam's [2001] paper, short rates, term spreads, and default spreads significantly decrease market liquidity (positive coefficients). The effects of recent market trends on market illiquidity are asymmetric. There is no significant effect on market illiquidity if the past 3-month market return is positive (MA3MKT+). In contrast, the market becomes less liquid if the past 3-month market return is negative (MA3MKT−).[13] Other control variables, including the past 3-month market volatility and the three macro-economic variables, do not have significant effects on market illiquidity.

Finally, the last two columns report the results of the regression that includes institutional sentiment index, control variables, and monthly dummies as independent variables. The coefficient of institutional sentiment is again negative and significant, indicating that institutional sentiment significantly increases market liquidity even after taking account of the changes in short rates and spreads, recent market movement, and the changes in macro-economic variables. The adjusted $R^2$ increases from 0.34 when there are only monthly dummies and control variables in the regression to 0.45 when institutional sentiment is also added in the regression. The coefficient of institutional sentiment, −0.5462, indicates that if the index increases by 1%, the logarithm of illiquidity value would decrease by 0.55%. This number is economically significance because the mean of monthly changes in the logarithm of illiquidity, as shown in Table 1, is about 0.61%.

Panel B reports the regression results during the sample period from August 1987 to December 2007. The results show that the seasonal pattern still remains when only monthly dummies are present in the regression. The results are somewhat different from those in Panel A when control variables are also included as independent variables. Specifically, the term spread and the short rate are no longer significant during this period, while the default spread still has a significantly positive coefficient. In addition, previous returns in the past do not have a significant impact on current market liquidity.

When the institutional sentiment index and the individual sentiment index enter the regressions separately, both of them have negative and significant coefficients with or without control variables in the regressions. The results show that the stock market is more liquid when investor sentiment, either institutional sentiment or individual sentiment, increases.[14]

Another finding in this panel is that the coefficients of institutional sentiment are larger in absolute values and more significant than those on individual sentiment. The last two columns report the results when both the institutional sentiment and the individual sentiment appear in the same regression. The results show that the coefficients of both sentiment measures are significant. Moreover, the coefficient of institutional sentiment is more than two times of the coefficient of individual sentiment. A Wald test with the null hypothesis that the coefficient of institutional sentiment equals to the coefficient of individual sentiment is rejected at the 10% level. This result tends to suggest that institutional sentiment have a stronger effect on market liquidity than individual sentiment.

In summary, Table 4 shows that the stock market is more liquid when investor sentiment is higher after controlling for short rates, term spreads, default spreads, recent market trend and volatility, and macroeconomic conditions.[15] The results are consistent with the theoretical prediction that higher investor sentiment increases stock market liquidity. Moreover, institutional sentiment tends to have a much stronger effect than individual sentiment in improving market liquidity.[16]

## INVESTOR SENTIMENT, MARKET TRADING VOLUME, AND MARKET LIQUIDITY

The empirical results in the above section demonstrate that investor sentiment and market liquidity are correlated. Moreover, the evidence from the Granger causality tests and the time-series regressions is consistent with the theoretical prediction that investor sentiment increases market liquidity. If investor sentiment increases liquidity through either the two direct channels or the indirect channel, then market trading volume should also increase. This is because, as suggested in theory, higher investor sentiment

may create noise traders' demand, which then produces more noise trading; may increase the proportions of irrational market makers, which induces more informed trading; or may indicate that investors are more overconfident, which generates more trading volume (Odean [1998]). In this section, I directly examine whether investor sentiment increases trading volume.

### Investor Sentiment and Market Trading Volume

I use market turnover to measure market trading volume. Market turnover is constructed in the following steps. First, I calculate daily turnover for each stock as the daily share volume divided by its total share outstanding. Daily turnover is measured in percentage terms. Second, I compute monthly turnover for each stock by averaging daily turnover within a month. Finally, market turnover is defined as the equal-weighted or value-weighted average of individual stock monthly turnover. The market capitalization of each stock at the beginning of the year is used as the weight to compute value-weighted average. To be consistent with the Amihud illiquidity measure, I use all common stocks on the NYSE and AMEX to compute monthly market turnover. Table 1 reports the descriptive statistics of the logarithm of market turnover (Panel A) and its first differences (Panel B). As shown in the table, the mean of the logarithm of market turnover is −1.2797, which indicates that the average market turnover during the sample period is about $e^{-1.2797}$ or 0.28%.

Table 1 reports the correlation coefficients between turnover, illiquidity, and sentiment in levels (Panel A) and in changes (Panel B). The results reveal that larger market trading volume is related to higher investor sentiment. In Panel A, the correlation is 0.338 between turnover and institutional sentiment and 0.1957 between turnover and individual sentiment. The changes in turnover are also positively correlated with changes in institutional and individual sentiment as reported in Panel B. Another finding, which is consistent with the existing literature, is that higher trading volume is related to higher market liquidity (lower illiquidity). The correlation between turnover and illiquidity is negative in levels (−0.9255 in Panel A) and in changes (−0.1405 in Panel B).

Table 2 compares the average values of market turnover in high and low investor sentiment subperiods. The results show that market turnover is higher in the high sentiment period than those in low sentiment period. The means of market turnover in higher institutional (individual) sentiment months are significantly higher than those in low institutional (individual) sentiment months.

Table 5 reports the results of contemporaneous time-series regressions in which monthly changes in market turnover is the dependent variable. As shown in the table, institutional sentiment has significantly positive coefficient, 0.4383, which suggests that a 1% increase in institutional sentiment leads to an increase in the logarithm of market turnover by 0.44%. This number is economically significant, given the fact that the mean of monthly changes in the logarithm of market turnover is around 0.57% (Table 1). In comparison, the coefficient of individual sentiment is positive (0.1269) and significant at the 10% level.[17]

TABLE 5
Investor Sentiment and Market Turnover

| | Coefficient | t-stat | Coefficient | t-stat |
|---|---|---|---|---|
| Institution | 0.4383 | 4.31 | | |
| Individual | | | 0.1269 | 1.93 |
| ShortRate | −6.8110 | −2.15 | −4.6246 | −0.70 |
| TermSpread | −5.2628 | −1.60 | −2.9377 | −0.75 |
| DefaultSpread | 0.7438 | 0.08 | 11.4120 | 1.40 |
| MA3MKT+ | 0.3385 | 0.95 | 0.3712 | 0.98 |
| MA3MKT- | 0.3732 | 0.59 | 0.7292 | 1.16 |
| MA3\|MKT\| | −1.8535 | −3.85 | −1.1980 | −2.54 |
| CPI | 4.7775 | 2.80 | 3.9632 | 1.45 |
| Unemploy | 1.5090 | 0.39 | 3.4548 | 0.69 |
| DispIncome | 0.2707 | 0.38 | −0.9829 | −1.60 |
| Intercept | 0.1531 | 6.01 | 0.1302 | 6.63 |
| Adjusted $R^2$ | 0.3004 | | 0.2333 | |

*Note*. In the contemporaneous time-series regression, the dependent variable is the monthly change in the logarithm of equal-weighted market turnover. The independent variables include monthly change in institutional (individual) sentiment and all other variables defined in Table 4. The institutional sentiment regression uses the data in the whole sample period from January 1976 to December 2007 and the individual sentiment regression uses the data in the period from August 1987 to December 2007. The coefficients of monthly dummies are omitted.

Overall, the results of investor sentiment and market turnover from Tables 1, 2, and 5 are consistent with the theoretical prediction that market trading volume is larger when investor sentiment is higher.

### Investor Sentiment, Market Trading Volume, and Market Liquidity

The Amihud illiquidity measure has two components: trading volume in the denominator and the absolute price changes (return) in the numerator. Given the evidence in Table 5 that market trading volume is larger when investor sentiment is higher, is it possible that the effect of investor sentiment on liquidity is solely because sentiment increases trading volume (the denominator) but has no effect on the price change (the numerator)? One way to test this is to add the change in turnover as an additional independent variable in the contemporaneous illiquidity regression and see whether sentiment still affects Amihud illiquidity after controlling for turnover. The results are reported in Table 6.

As shown in the table, when the changes in market turnover and other control variables are included in the regression as independent variables, turnover has a negative and significant coefficient. This finding that the market is more liquid (illiquidity value is lower) when turnover is higher is

TABLE 6
Investor Sentiment, Market Turnover, and Market Illiquidity

| | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat |
|---|---|---|---|---|---|---|---|---|
| Institution | | | −0.5237 | −6.47 | | | −0.5718 | −4.91 |
| Individual | | | | | −0.3963 | −5.33 | −0.2199 | −2.63 |
| Turnover | −0.2343 | −2.81 | −0.0515 | −0.73 | 0.0325 | 0.25 | 0.0831 | 0.94 |
| ShortRate | 10.3764 | 4.06 | 5.5185 | 1.73 | 2.7602 | 0.55 | −4.2659 | −0.83 |
| TermSpread | 9.6893 | 3.30 | 4.8334 | 1.32 | −0.5657 | −0.18 | −6.3437 | −1.89 |
| DefaultSpread | 21.6033 | 4.29 | 15.0162 | 2.30 | 6.6400 | 0.83 | −6.7444 | −0.79 |
| MA3MKT+ | 0.3943 | 0.72 | 0.0142 | 0.03 | −0.4209 | −0.66 | −0.3958 | −0.7 |
| MA3MKT− | −1.6066 | −1.96 | −1.6398 | −2.20 | −1.1513 | −1.30 | −1.2965 | −1.7 |
| MA3\|MKT\| | −1.0618 | −1.75 | −0.4930 | −0.79 | −0.1834 | −0.24 | −0.1412 | −0.2 |
| CPI | 1.5202 | 0.87 | −0.3021 | −0.17 | 1.0180 | 0.32 | −0.8106 | −0.25 |
| Unemploy | 0.3578 | 0.08 | −1.5364 | −0.42 | 1.1272 | 0.16 | −0.4029 | −0.06 |
| DispIncome | 0.3671 | 0.37 | 0.8757 | 0.82 | 1.6018 | 1.51 | 1.6482 | 1.27 |
| Intercept | 0.0889 | 2.88 | 0.0646 | 2.15 | 0.0288 | 0.71 | 0.0264 | 0.67 |
| Adjusted $R^2$ | 0.3646 | | 0.4480 | | 0.3857 | | 0.4519 | |

*Note*. In the contemporaneous time-series regression, the dependent variable is the monthly change in the logarithm of equal-weighted market illiquidity. The independent variables include the monthly change in the logarithm of equal-weighted market turnover, monthly change in institutional (individual) sentiment, and all other variables defined in Table 4. The coefficients of monthly dummies are omitted.



consistent with the theoretical prediction that higher trading volume increases stock liquidity.

The most striking results in Table 6 are that investor sentiment increases market liquidity even after controlling for market trading volume. When institutional sentiment and individual sentiment are added in the regressions either separately or together, both measures have significantly negative coefficients. In addition, the coefficients of turnover are no longer significant when sentiment measures are in the regression. This evidence indicates that the effects of investor sentiment on liquidity are not restricted to increasing trading volume. The price impact is also smaller when sentiment is higher.

## SHORT-SALES CONSTRAINTS

The evidence in previous sections is consistent with the theoretical prediction that investor sentiment increases stock market liquidity. As discussed earlier, there are two possible links through which investor sentiment may increase liquidity. For the direct link, liquidity increases because higher investor sentiment may generate more noise trading or higher proportions of irrational market makers given the short-sales constraints. The existence of short-sales constraints is crucial for this explanation. Without this restriction, noise trading and the proportion of irrational market makers would increase when investor sentiment moves in either direction: very high or very low. The consequence is liquidity increases when the variation in sentiment is larger.

The indirect link between investor sentiment and liquidity suggests that higher sentiment indicates that the level of investor overconfidence is higher, which, in turn, increases market liquidity. Although short-sales constraints are not important for the explanation, sentiment still works in one direction—higher sentiment indicates higher overconfidence. If investors' overconfidence level is also higher when sentiment is very low, we should observe liquidity increases when sentiment changes in both directions.

If short-sales constraints are not important or if overconfidence levels are higher at both high and low sentiment levels, we should observe that the market is more liquid when there is a larger variation in sentiment. In this section, I first explore whether the variation in sentiment increases market liquidity. Then I directly examine whether short-sales constraints are important to explain the evidence that higher sentiment increases market liquidity.

### Variation in Investor Sentiment and Market Liquidity

To examine whether the variation of sentiment is related to market liquidity, I use monthly changes in the standard deviation of investor sentiment to replace monthly changes in investor sentiment levels as the explanatory variable in the contemporaneous illiquidity regressions. The standard deviation of investor sentiment is estimated as the standard deviation of weekly institutional investor sentiment or individual investor sentiment within the month. The regression results are reported in Table 7.

The results do not support the argument that the standard deviation of sentiment affects market liquidity. As shown in Panel A of the table, when the sample period is from January 1976 to December 2007, the coefficients of the standard deviation of institutional sentiment are not significant in the regressions with or without control variables. When the sample period is from August 1987 to December 2007 (Panel B), the standard deviations of both sentiment

TABLE 7
Variation in Investor Sentiment and Market Illiquidity

Panel A: Institutional Investor Sentiment (Jan 1976 to Dec 2007)

| | Coefficient | t-stat | Coefficient | t-stat |
|---|---|---|---|---|
| Stdv(institution) | 0.2693 | 1.22 | 0.2222 | 1.11 |
| ShortRate | | | 13.0542 | 4.61 |
| TermSpread | | | 11.8317 | 3.80 |
| DefaultSpread | | | 22.4298 | 3.93 |
| MA3MKT+ | | | 0.2969 | 0.55 |
| MA3MKT− | | | −1.6299 | −2.00 |
| MA3\|MKT\| | | | −0.5761 | −0.93 |
| CPI | | | 0.7090 | 0.37 |
| Unemploy | | | 0.0509 | 0.01 |
| DispIncome | | | 0.1589 | 0.16 |
| Intercept | 0.0373 | 1.70 | 0.0482 | 1.88 |
| Adjusted $R^2$ | 0.3065 | | 0.3421 | |

Panel B: Institutional and Individual Investor Sentiment (Aug 1987 to Dec 2007)

| | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat | Coefficient | t-stat |
|---|---|---|---|---|---|---|---|---|
| Stdv(institution) | −0.2352 | −0.92 | | | −0.2282 | −0.97 | | |
| Stdv(Individual) | | | −0.1457 | −0.77 | | | −0.2028 | −0.99 |
| ShortRate | | | | | 8.8720 | 1.44 | 7.4706 | 1.16 |
| TermSpread | | | | | 2.8191 | 0.68 | 1.4575 | 0.34 |
| DefaultSpread | | | | | 18.6632 | 2.45 | 17.3404 | 2.28 |
| MA3MKT+ | | | | | 0.1157 | 0.16 | 0.1155 | 0.16 |
| MA3MKT− | | | | | −0.8705 | −0.78 | −0.8867 | −0.80 |
| MA3\|MKT\| | | | | | −0.1969 | −0.20 | −0.1233 | −0.13 |
| CPI | | | | | 3.7511 | 1.15 | 4.9753 | 1.36 |
| Unemploy | | | | | 1.6206 | 0.19 | −0.2077 | −0.02 |
| DispIncome | | | | | 0.8800 | 0.60 | 1.1896 | 0.83 |
| Intercept | 0.0357 | 1.06 | 0.0345 | 1.02 | 0.0261 | 0.70 | 0.0157 | 0.42 |
| Adjusted $R^2$ | 0.3081 | | 0.3090 | | 0.3083 | | 0.3121 | |

*Note*. In the contemporaneous time-series regression, the dependent variable is the monthly change in the logarithm of equal-weighted market illiquidity. The independent variables include Stdv(institution) or Stdv(individual), which is the monthly changes in the standard deviation of investor sentiment computed as the standard deviation of weekly institutional sentiment or individual sentiment within the month, and all other variables defined in Table 4. Panel A reports the results of institutional sentiment in the whole sample period from January 1976 to December 2007. Panel B reports the results of institutional sentiment and individual sentiment in the period from August 1987 to December 2007. The coefficients of monthly dummies are omitted.



measures have negative but not significant coefficients with or without control variables in the regressions. Overall, the results in this table do not suggest that the variation in sentiment increases market liquidity. The effect of sentiment on liquidity is only in one direction—higher investor sentiment leads to a more liquid market.

## Short-Sales Constraints

In this section, I provide empirical evidence on whether the short-sales constraints are necessary for the finding that investor sentiment increases market liquidity. If the effect of sentiment on liquidity is different when short-sale constraints vary across stocks, then it shows the direct channel that sentiment increases liquidity does exist.

Following the studies by Chen, Hong, and Stein [2002] and Nagel [2005], I use the number of institutional investors holding shares as the proxy for short-sale constraints because short-selling involves borrowing stocks and institutional investors are major suppliers of the shares to borrow.[18] A stock with fewer institutional holders has smaller amounts of shares available to lend out, and therefore is difficult to short sell. The institutional holding data is from Thomson Financial CDA/Spectrum Institutional (13f) Holdings. Only stocks listed on the NYSE and AMEX are included. The number of institutional holders is defined as the number of aggregate institutional investors that hold the stock at the end of each quarter.[19]

If short-sales constraints are important, we would observe that investor sentiment has a larger effect on the liquidity of stocks that are more difficult to short sell, that is, stocks with fewer institutional holders. To test this, I sort stocks based on the number of institutional holders and form five quintile portfolios. Stocks in Portfolio 1 have the smallest number of institutional holders (the bottom 20%), while stocks in Portfolio 5 have the largest number of

institutional holders (the top 20%). Stocks that do not have a record of holding by institutions in the CDA/Spectrum (13f) data are classified into Portfolio 0. I then calculate the average (equal-weighted or value-weighted) values of illiquidity for each portfolio and run the contemporaneous time-series regressions of the monthly change in portfolio illiquidity on the monthly changes in investor sentiment (either institutional sentiment or individual sentiment) and other control variables. Table 8 reports the coefficients of investor sentiment from each portfolio illiquidity (equal-weighted) regressions.[20] In order to examine whether sentiment has a larger effect on the liquidity of stocks with smaller number of institutional holders, I estimate the coefficients of sentiment from the regressions in which the dependent variables are the monthly change in the difference between the illiquidity of portfolio 5 and the illiquidity portfolio 0. The results are reported at the bottom of Table 8.

As shown in Table 8, the coefficients of investor sentiment for all the portfolios are negative and significant. More importantly, the coefficients from regressions of Portfolio 0 (−0.9570 for institutional sentiment and −1.7326 for individual sentiment) are more negative than those from regressions of other portfolios. In the last row of the table, the coefficient of individual sentiment from portfolio 0 is significantly larger in absolute values than that from portfolio 5. The results suggest that individual investor sentiment has a larger effect on the liquidity of those stocks with fewer or no institutional holders; that is, stocks that are most difficult to short sell. However, there is no similar result for institutional investor sentiment.

TABLE 8
Number of Institutional Holders

| | | Institution | Individual |
|---|---|---|---|
| Portfolio 0 | Mean | −0.9570 | −1.7326 |
| | t-stat | −2.20 | −3.48 |
| Portfolio 1 | Mean | −0.5872 | −0.4036 |
| | t-stat | −6.05 | −5.05 |
| Portfolio 2 | Mean | −0.7799 | −0.4841 |
| | t-stat | −7.65 | −7.43 |
| Portfolio 3 | Mean | −0.9508 | −0.4919 |
| | t-stat | −10.99 | −4.88 |
| Portfolio 4 | Mean | −0.8525 | −0.4751 |
| | t-stat | −11.78 | −5.37 |
| Portfolio 5 | Mean | −0.7126 | −0.4098 |
| | t-stat | −12.98 | −6.54 |
| Portfolio 5–Portfolio 0 | Mean | 0.2143 | 1.3713 |
| | t-stat | 0.50 | 2.63 |

*Note*. In the contemporaneous time-series regression, the dependent variable is the monthly change in the logarithm of equal-weighted portfolio illiquidity. The independent variables include the monthly change in institutional (individual) sentiment and all other variables defined in Table 4. Portfolio illiquidity is the average illiquidity of all the stocks in the portfolio. Portfolios 1 to Portfolio 5 are quintile portfolios based on the number of institutional holders. Portfolio 1 has stocks with the smallest number of institutional holders (bottom 20%), while Portfolio 5 has stocks with the largest number of institutional holders (top 20%). Stocks that do not have a record of holding by institutions are classified into Portfolio 0. The dependent variable in the regression of Portfolio5–Portfolio 0 is the monthly changes in the difference between the illiquidity of Portfolio 5 and the illiquidity of Portfolio 0. This table reports the coefficients of investor sentiment from each portfolio illiquidity regression.

Investor sentiment may increase market liquidity in both direct and indirect ways. The direct effect requires short-sales constraints, whereas the indirect effect does not. The results that short-sales constraints are important in the relation between individual sentiment and market liquidity suggest the existence of the direct effect that individual sentiment may have on stock market liquidity.[21]

## CONCLUSION

This paper examines whether investor sentiment and stock market liquidity are related for a sample of stocks on the NYSE and AMEX from 1976 to 2007. Using the liquidity measure developed by Amihud [2002] and survey-based investor sentiment measures, I find that the stock market is more liquid when sentiment indices rise, i.e., when investors are more bullish. Moreover, the Granger causality tests suggest that investor sentiment Granger-causes market liquidity. This finding is consistent with the theoretical prediction that investor sentiment increases stock liquidity.

Further analyses show that market trading volume also increases when investor sentiment is higher. More importantly, the result that market liquidity increases when investor sentiment is higher still hold even if we control for trading volume in the regressions. This finding implies that investor sentiment has two effects on market liquidity: increasing the trading volume and reducing the price impact.

Theoretical studies suggest that higher investor sentiment may increase stock liquidity in a direct manner by generating more noise trading or by increasing the proportions of irrational market makers, or in an indirect way by indicating a higher overconfidence level in the market. The direct way in which investor sentiment increases market liquidity requires short-sales constraints, while the indirect way does not. To examine whether the direct effect that sentiment have on liquidity does exist, I test whether short-sales constraints are important to the relation between investor sentiment and market liquidity. The results show that short-sales constraints are important for individual sentiment to increase market liquidity, which suggests the existence of the direct effect that individual sentiment may have on stock market liquidity.

The empirical evidence in this paper establishes a link between two research areas: liquidity and investors' behavior. On the one hand, this paper contributes to the research on liquidity by identifying one of the sources of the

variation in stock market liquidity—investor sentiment. On the other hand, it adds to the literature on investors' behavior by revealing how investor sentiment, by changing investors' behavior, affects aggregate liquidity variation. The current literature in these two areas has reported that both market-wide liquidity and investor sentiment influence stock market returns.[22] The connection between investor sentiment and market liquidity proposed in this paper helps to improve our understanding in the relation among investors' behavior, liquidity, and returns.

## NOTES

1. Examples are Amihud [2002], Acharya and Pedersen [2005], Avramov, Chordia, and Goyal [2006], and Chan, Jain and Xia [2008]. In particular, a few recent studies use the aggregate Amihud illiquidity measure as a proxy for market illiquidity. For instance, Goyenko and Ukhov [2009] use this measure in examining the relationship between stock and bond market liquidity. Naes, Skjeltorp, and Odegaard [2011] find that stock market liquidity is related to the business cycle. Moreover, research on commonality in liquidity, such as studies by Jensen and Moorman [2010] and Watanabe and Watanabe [2008], also use the aggregate Amihud illiquidity measure as a proxy for market-wide illiquidity.
2. For stocks to be included in the computation, I follow the criteria adopted by Amihud [2002] and Korajczyk and Sadka [2008]: (1) the stock has return and volume data for more than 15 days during the current month; (2) the stock must be listed at the end of the current month; (3) the stock price is greater than $5 at the end of the current month; (4) the stock has data on market capitalization at the end of the current month in the CRSP database. I also eliminate outliers—stocks whose estimated illiquidity in the current month is in the highest or lowest 1% tails of the distribution (after satisfying criteria 1–4).
3. NASDAQ stocks are excluded from the sample because unlike the volumes reported on the NYSE and AMEX, the volumes on NASDAQ include inter-dealer trades which may results in artificially higher volume figures on those stocks.
4. Inflation adjusted illiquidity (t) = raw illiquidity (t) * [CPI (t) / CPI (base)] while the base month is July 1962.
5. The patterns of the logarithm of value-weighted market illiquidity are similar and thus are not presented here.
6. On May 1, 1975 ruling from the Securities and Exchange Commission (SEC) eliminated fixed trade commissions.
7. I also conduct the same tests using two survey-based consumer sentiment measures: the Conference Board Consumer Confidence Index and the University of Michigan Consumer Sentiment Index. The results are similar to those in the paper: market liquidity increases when consumer sentiment is higher.
8. The logarithm of illiquidity is not stationary over the sample period but its first difference is. So I use the first difference in the logarithm of illiquidity and the first differences in sentiment to conduct the Granger causality tests.
9. The number of lags in the Granger causality tests is chosen according to the Akaike Information Criterion.
10. The Granger causality tests in Table 3 focus only on the relationship between sentiment and illiquidity without considering the influences of other factors. In an unreported time-series regression analysis, I further examine whether lagged investor sentiment affects market liquidity after including other factors. The dependent variable is the monthly change in the logarithm of equal-weighted (or value-weighted) market illiquidity. The independent variables include changes in sentiment and all control variables (defined in Table 4) in the previous month. I also add changes in market illiquidity in the previous month as an additional control variable. The results are consistent with the finding from the Granger causality tests. Both lagged institutional sentiment and individual sentiment increase current market liquidity even after controlling for other factors in the previous month.
11. The results of regressions with value-weighted illiquidity are similar, and therefore are not reported.
12. Chordia, Sarkar, and Subrahmanyam [2005], Hong and Yu [2009], and DeGennaro, Kamstra, and Kramer [2007] have shown seasonal variations in overall stock market liquidity, although there is no consistent evidence on which months the market is more liquid. DeGennaro, Kamstra, and Kramer [2007] attribute the liquidity variation to seasonal changes in risk aversion among market makers. Hong and Yu [2005] associate their finding of low liquidity in the summer to the fact that important traders are on summer vacation.
13. The variable MA3MKT− has negative values. Therefore a negative coefficient of this variable means MA3MKT− has a positive effect on market illiquidity.
14. I also form 10 size-decile portfolios based on stocks' market capitalization and then estimate the same contemporaneous time-series regressions for each size portfolio separately. The results show that the liquidity of stocks in all 10 portfolios increases

when either institutional sentiment or individual sentiment is higher.

15. To examine whether the results are concentrated in a particular time period, I also include time-period dummy variables. I use the NBER business cycle data to define one dummy variable—Recession, which takes the value of 1 if the month falls in an NBER contraction period or 0 if otherwise. The results are similar to those in Table 4. I also include bull and bear stock market dummies which are defined in various ways using CRSP equal-weighted or value-weighted returns. The basic finding that the stock market is more liquid when investor sentiment is higher does not change.
16. I also examine whether the Amihud illiquidity measure is a proxy for market return volatility and the relation between investor sentiment and Amihud illiquidity actually reflects the connection between sentiment and volatility. The empirical results do not support this argument. First, the Amihud measure and various market return volatility measures are not highly correlated. Second, the finding that market liquidity increases when investor sentiment is higher still exists after we control for market return volatility. Moreover, this finding is not affected by the choices of different volatility measures.
17. If we exclude the data in 2007 from the sample, the coefficient of individual sentiment is positive (0.1648) and significant (t = 2.85) at the 1% level. The results seem to suggest that the effect of individual sentiment on turnover is weaker in year 2007. Institutional sentiment again has a positive (coefficient = 0.4978) and significant effect (t = 5.72) on market turnover after excluding the data in 2007.
18. I also use the percentage of shares held by institutional investors as the proxy for short-sale constraints, and the results are similar.
19. Institutional investors are defined as those institutions that appear in CDA Spectrum. According to CDA Spectrum, all institutional investors with more than $100 million in equity ownership must report their holdings to SEC in quarterly 13F filings.
20. The results for value-weighed portfolio illiquidity are similar.
21. The evidence in Table 8 only suggest that one possible way that individual sentiment may increase liquidity. It does not exclude the possibility of the existence of the indirect channel (overconfidence). On the other hand, the fact that there is no similar evidence for institutional sentiment does not necessary suggest that short-sales constraints are not important here. Some institutional investors, such as mutual funds (see Almazan, Brown, Carlson, and Chapman [2004]), face very stringent regulations that prevent them from short selling at all. If this is the case, we certainly cannot find the difference in liquidity increases for stocks that are more difficult to short sell (Portfolio 0) and stocks that are easier to short sell (Portfolio 5).
22. Several studies focus on the relationship between stock market liquidity and market returns. For example, using the aggregate market illiquidity measure, Amihud [2002] show that, overtime, expected stock market illiquidity positively affects expected market excess returns. Jones [2002] finds that aggregate market liquidity predicts excess stock market return up to three years ahead. Bekaert, Harvey, and Lundblad [2007] further explore the time-series liquidity and expected return relationship by using data from 19 emerging markets and the United States. They report that market liquidity significantly predicts future market returns. As for the research on the relationship between investor sentiment and stock market returns, Brown and Cliff [2004] show that sentiment is strongly correlated with contemporaneous market returns. Baker and Wurgler [2007] report that a sentiment index predicts market-level U.S. returns. Baker, Wurgler, and Yuan [2012] examine sentiment in six major stock markets and find that global sentiment is a contrarian predictor of country-level market returns.

## REFERENCES


Acharya, V. V. and L. H. Pederson. "Asset Pricing with Liquidity Risk." *Journal of Financial Economics*, 77, (2005), pp. 375–410.

Almazan, A., K. C. Brown, M. Carlson, and D. A. Chapman. "Why Constrain Your Mutual Fund Manager?" *Journal of Financial Economics*,73, (2004), pp. 289–321.

Amihud, Y. "Illiquidity and Stock Returns: Cross-section and Time-series Effects." *Journal of Financial Markets*, 5, (2002), pp. 31–56.

Avramov, D., T. Chordia, and A. Goyal. "Liquidity and Autocorrelations in Individual Stock Returns." *Journal of Finance*, 61, (2006), pp. 2365–2394.

Baker, M. and J. C. Stein. "Market Liquidity as a Sentiment Indicator." *Journal of Financial Market*, 7, (2004), pp. 271–299.

Baker, M. and J. Wurgler. "Investor Sentiment and the Cross-section of Stock Returns." *Journal of Finance*, 61, (2006), pp. 1645–1680.

Baker, M. and J. Wurgler. "Investor Sentiment in the Stock Market." *Journal of Economic Perspectives*, 21, (2007), pp. 129–151.

Baker, M., J. Wurgler, and Y. Yuan. "Global, Local, and Contagious Investor Sentiment." *Journal of Financial Economics*, 104, (2012), pp. 272–287.

Bekaert, G., C. R. Harvey, and C. Lundblad. "Liquidity and Expected Returns: Lessons from Emerging Markets." *Review of Financial Studies*, 20, (2007), pp. 1783–1831.

Brown, G. W. and M. T. Cliff. "Investor Sentiment and the Near-Term Stock Market." *Journal of Empirical Finance*,11, (2004), pp. 1–27.

Chan, J. S. P., R. Jain, and Y. Xia. "Market Segmentation, Liquidity Spillover, and Closed-End Country Fund Discounts." *Journal of Financial Markets*, 11, (2008), pp. 377–399.

Chen, J., H. Hong, and J. C. Stein. "Breath of Ownership and Stock Returns." *Journal of Financial Economics*, 66, (2002), pp. 171–205.

Chordia, T., R. Roll, and A. Subrahmanyam. "Commonality in Liquidity." *Journal of Financial Economics*, 56, (2000), pp. 3–28.

Chordia, T., R. Roll, and A. Subrahmanyam. "Market Liquidity and Trading Activity." *Journal of Finance* 56, (2001), pp. 501–530.

Chordia, T., A. Sarkar, and A. Subrahmanyam. "An Empirical Analysis of Stock and Bond Market Liquidity." *Review of Financial Studies*, 18, (2005), pp. 85–129.

DeGennaro, R. P., M. J. Kamstra, and L. A. Kramer. "Does Risk Aversion Vary During the Year? Evidence from Bid-Ask Spreads." Working Paper Series. (2008). Retrieved from http://ssrn.com/abstract=624901 or http://dx.doi.org/10.2139/ssrn.624901

De Long, J. B., A. Shleifer, L. H. Summers, and R. J. Waldmann. "Noise Trader Risk in Financial Markets." *Journal of Political Economy*, 98, (1990), pp. 703–738.

Fisher, K. L. and M. Statman. "Investor Sentiment and Stock Returns." *Financial Analysts Journal*, 56, (2000), pp. 16–23.

Gervais, S. and T. Odean. "Learning to be Overconfident." *Review of Financial Studies*, 14, (2001), pp. 1–27.

Goyenko, R. Y. and A. D. Ukhov. "Stock and Bond Market Liquidity: A Long-Run Empirical Analysis." *Journal of Financial and Quantitative Analysis*,44, (2009), pp. 189–212.

Hasbrouck, J. "Trading Costs and Returns for US Equities: Estimating Effective Cost from Daily Data." *Journal of Finance*, 64, (2009), pp. 1445–1477.

Hasbrouck, J. and D. Seppi. "Common Factors in Prices, Order Flows, and Liquidity." *Journal of Financial Economics*, 59, (2001), pp. 383–411.

Hong, H., and J. Yu. "Gone Fishin': Seasonality in Trading Activity and Asset Prices." *Journal of Financial Markets*, 12, (2009), pp. 672–702.

Huberman, G. and D. Halka. "Systematic Liquidity." *Journal of Financial Research*, 24, (2001), pp. 161–178.

Irwin, F. W. "Stated Expectations as Functions of Probability and Desirability of Outcomes." *Journal of Personality*, 21, (1953), pp. 329–335.

Jensen, G. R. and T. Moorman. "Inter-Temporal Variation in the Illiquidity Premium." *Journal of Financial Economics*, 98, (2010), pp. 338–358.

Jones, C. M. "A Century of Stock Market Liquidity and Trading Costs." Working Paper. Columbia University. (2002).

Kahneman D. and M. W. Reipe. "Aspects of Investor Psychology: Beliefs, Preferences, and Biases Investment Advisors Should Know About." *Journal of Portfolio Management*, 24, (1998), pp. 52–65.

Korajczyk, R. A. and R. Sadka. "Pricing the Commonality across Alternative Measure of Liquidity." *Journal of Financial Economics*, 87, (2008), pp. 45–72.

Kyle, A. S. "Continuous Auctions and Insider Trading." *Econometrica*, 53, (1985), pp. 1315–1336.

Lee, C. M. C., A. Shleifer, and R. H. Thaler. "Investor Sentiment and the Closed-end Fund Puzzle." *Journal of Finance*, 46, (1991), pp. 75–109.

Marks, R. "The Effect of Probability, Desirability, and 'Privilege' on the Stated Expectations of Children." *Journal of Personality*, 19, (1951), pp. 332–351.

Naes, R., J. A. Skjeltorp, and B. A. Odegaard. "Stock Market Liquidity and the Business Cycle." *Journal of Finance*, 66, (2011), pp. 139–176.

Nagel, S. "Short Sales, Institutional Investors, and the Cross-section of Stock Returns." *Journal of Financial Economics*, 78, (2005), pp. 277–309.

Newey, W. and K. West. "A Simple, Positive Semi-definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix." *Econometrica*, 55, (1987), pp. 703–708.

Odean, T. "Volume, Volatility, Price, and Profit When All Traders Are Above Average." *Journal of Finance*, 53, (1998), pp. 75–109.

Pastor, L. and R. F. Stambaugh. "Liquidity Risk and Expected Stock Returns." *Journal of Political Economy*, 111, (2003), pp. 642–685.

Qiu, L. and I. Welch. "Investor Sentiment Measures." Working Paper. Brown University. (2006).

Watanabe, A. and M. Watanabe. "Time-Varying Liquidity Risk and the Cross-Section of Stock Returns." *Review of Financial Studies*,21, (2008), 2449–2486.

Wooldridge, J. M. *Introductory Econometrics: A Modern Approach*. Manson, IA: South-Western, 2002.