Amihud Premium: The Compensation for Illiquidity or Mispricing?

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Abstract: This paper aims to explore whether the cause of return premium associated with the Amihud (2002) illiquidity measure is the compensation for illiquidity or mispricing. This paper defines the Amihud premium as the difference in expected returns between high-Amihud-portfolio and low-Amihud-portfolio. Firstly, this paper analyzes the monthly data from 2007 to 2018 and confirms that: Amihud premium is robust in the Chinese A-share market, and it is significant both economically and statistically and survives in different industries, market situations and months. Further analyses suggest that the Amihud premium is driven by its volume component.

This paper discovers that holding the low-Amihud-portfolio formed in the last month consistently generate negative returns, while possessing the high-Amihud-portfolio yields high returns, even after controlling various risk factors. The negative return of low-Amihud-portfolio is direct evidence of its mispricing. Meanwhile, this paper rules out several alternative explanations including hedging, fund managers' moral hazard, and investors' gambling behaviors. Further, through event-study analyses, this paper points out that: (1) the high-Amihud-portfolio earns high return after the rapid drop of cumulative return and trading volume, coinciding with the explanation of illiquidity compensation; (2) the low-Amihud-portfolio receives negative returns after the surge of stock price and traded volume, indicating investors' overreaction. Based on asset pricing theories, this paper employs the double-sorting methodology to test several important deductions of "illiquidity compensation" and "mispricing," and confirms that the main pricing mechanism of high-Amihud-portfolio is "illiquidity compensation," and that of low-Amihud-portfolio is "mispricing." Additionally, analyses of daily Amihud premium are consistent with previous results using monthly data. Finally, this paper concludes that high-Amihud-portfolio's high return associated with compensation for illiquidity, along with low-Amihud-portfolio's low performance caused by mispricing, compose the Amihud premium in the A-share market.

Keywords: Amihud Illiquidity Measure; Compensation for Illiquidity; Mispricing

1. Introduction

1.1 Research background

This paper intends to resolve the debate between Lou and Shu (2007) [1] and Amihud and Noh (2018) [2] about why Amihud (2002) [3] was priced. Amihud (2002) [3] proposed to use the average value of the ratio of the absolute value of the daily rate of return of the stock to the transaction amount to describe the illiquidity of the stock over a period of time. The specific formula is:

$$Amihud_{it} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{|r_{id}|}{Vol_{id}},$$

where $Amihud_{it}$ is the Amihud index of stock i in month t, $|r_{id}|$ and Vol_{id} are the absolute value of return and turnover of stock i on the dth trading day in month t, D_{it} is the stock i The number of trading days in month t. Amihud (2002) [3] mentioned that one of the advantages of the Amihud indicator is that it is easy to calculate, only the daily rate of return and turnover data are needed, and it is highly correlated with high-frequency liquidity indicators.

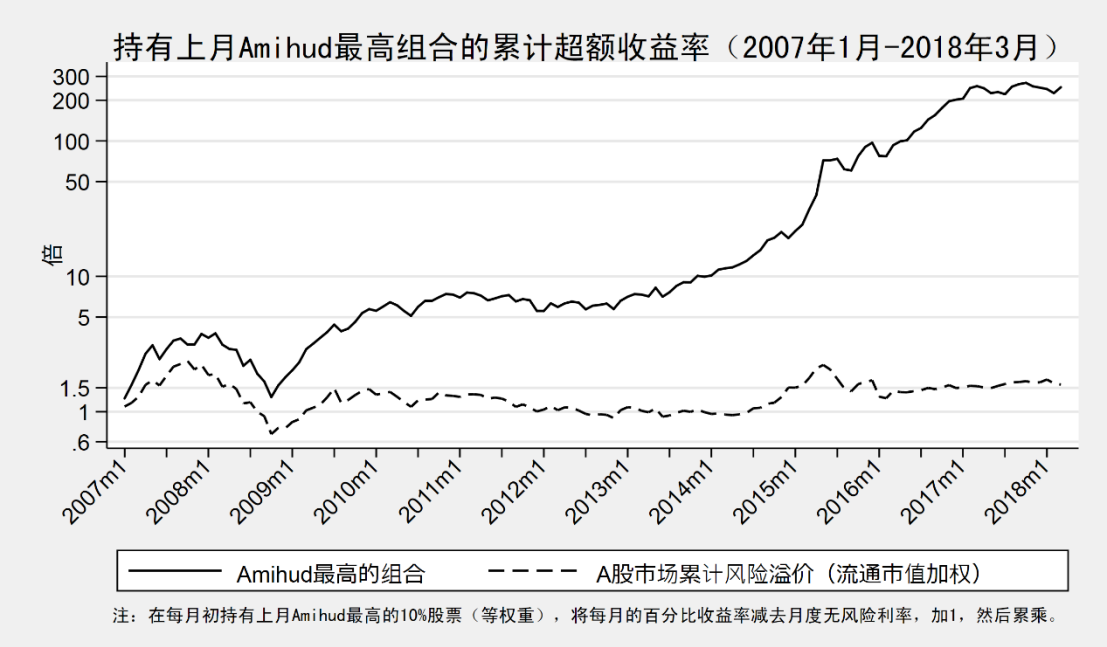

Figure 1: The cumulative excess return of the stock portfolio holding the highest Amihud indicator in the A-share market at the beginning of each month

Currently, the Amihud indicator has become one of the most widely used liquidity indicators

in the financial literature. Google Scholar shows that as of March 2018, the papers of Amihud (2002) [3] have been cited more than 7,000 times, and many of the citations are literature from top journals in economics and finance, which shows that the Amihud indicator has a very high status in the literature. Important, so the reason why the Amihud indicator is priced is worth looking into.

In most stock markets around the world, the Amihud indicator has a significant positive correlation with expected stock returns (Amihud et al, 2015) [4]. This paper defines the difference between the returns of the high Amihud stock portfolio and the low Amihud portfolio as the "Amihud premium." There is a pervasive "Amihud premium" in the A-share market. As shown in Figure 1, from January 2007 to March 2018, if investors buy the 10% stocks with the highest Amihud index in the previous month with equal weight at the beginning of each month, then the cumulative return will reach about 250 times, while the average return of the A-share market in the same period is about 50%. While cumulative yields fell during the 2008 subprime mortgage crisis and the 2015 stock market crash, the overall upward trend has been strong.

Why is the Amihud indicator such a strong predictor of stock returns? At present, there is still a lot of debate in the academic community on the reasons for the formation of the "Amihud premium." The "Amihud Premium" is often thought of as compensation for stock illiquidity. From the perspective of the structure of the Amihud indicator, what it wants to measure is the change in stock returns brought by the unit trading volume. The greater the impact of the unit trading volume on the stock price, the worse the stock liquidity is. Unfavorable attributes, so investors will demand higher returns for stocks with higher Amihud metrics as compensation. However, the interpretation of "illiquidity compensation" has been called into question recently. Lou and Shu (2017) [1] found that the mean value of the inverse of the daily transaction volume ($IVOL_{it} = \frac{1}{D_{it}} \sum_{d=1}^{D_{it}} \frac{1}{Vol_{id}}$) can fully explain the Amihud indicator priced components, and pointed out that the positive relationship between IVOL and expected stock returns is caused by "mispricing." In addition, Harris and Amato (2018) [5] re-conducted Amihud (2002) [3]'s analysis of the "Amihud premium" and found that using simpler indicators (such as the ratio of the monthly mean of |r| to the monthly mean of Vol) is very close to the Amihud index. Afterwards, Amihud and Noh (2018) [2] responded by arguing that Lou and Shu (2017) [1]'s decomposition of the Amihud indicator left out the part (DIF) related to the covariance of volatility and the inverse of trading volume and pointed out that DIF is significantly positively correlated with future stock returns. However, Lou and Shu (2018) [6] once again responded that DIF measures liquidity rather than illiquidity, and in fact DIF is

negatively correlated with Amihud indicator, so Amihud and Noh (2018) [2] The finding just shows that only the transaction volume component is related to illiquidity in the Amihud indicator. Until now, the discussion about the cause of the "Amihud Premium" continues.

The interpretation of "illiquidity compensation" is reasonable. Because the good liquidity of the stock means that the transaction cost is low, the transaction time is short and the amount that can be traded is large and other attributes that are beneficial to investors. Therefore, many investors, especially institutional investors with large capital, place great importance on stock liquidity. In fact, stocks that are more liquid in the A-share market typically have higher institutional holdings. So, for illiquid stocks, investors will demand higher returns as compensation.

On the other hand, the "Amihud premium" may also be caused by "mispricing." As pointed out by Baker and Stein (2004) [7], market liquidity is an indicator of investor sentiment, and in the presence of short selling constraints, high liquidity is a "symptom" of the market being dominated by irrational investors. In addition, Lou and Shu (2017) [1] pointed out that Amihud is only priced in the components related to transaction volume, and the impact of transaction volume on stock expected returns is considered to be closely related to asset bubbles or uncertainty (Scheinkman and Xiong, 2003 [8]; Zhang Zheng and Liu Li, 2006 [9]; Barinov, 2014 [10]). If the Amihud indicator measures the degree of speculation, the lower the Amihud indicator, the higher the degree of speculation, and the lower the future stock return, which can also explain the positive relationship between the Amihud indicator and the expected stock return.

1.2 The significance of this study

This paper hopes to provide solid evidence support for resolving the debate on the formation mechanism of the "Amihud premium" through detailed empirical analysis. Therefore, this paper uses the data of the A-share market and uses the standard analysis methods in the financial literature such as the Fama-MacBeth two-step method, the event study method, and the bivariate ranking to clarify that the formation mechanism of the "Amihud premium" is "illiquidity compensation" or "mispricing," while testing a range of asset pricing theories.

It is of great practical significance to explore the causes of "Amihud premium." On the one hand, this research can deepen investors' understanding of the relationship between stock liquidity and expected stock returns, so as to make more rational investment decisions, which is conducive to reducing the degree of "mispricing" in the market. On the other hand, the findings of this paper

can help policy makers to better understand the meaning of liquidity in the stock market, so as to realize the scientific formulation of financial market policies and regulations, which is conducive to maintaining the stability of the stock market, promoting the improvement of financial efficiency and giving full play to the capital market supports the functions of the real economy and enhances the overall competitiveness of the national economy.

1.3 Research problems and solutions

A difficulty in analyzing the formation mechanism of the "Amihud premium" is that the lower the Amihud indicator, the better the stock liquidity, which may also be accompanied by an increase in the degree of speculation. According to the interpretation of "illiquidity compensation" or "mispricing," an increase in stock liquidity or an increase in the degree of speculation corresponds to a lower expected return. In addition, "illiquidity compensation" and "mispricing" may exist at the same time, rather than an "either or other" relationship. The two effects are intertwined, which brings great challenges to the identification of the causes of "Amihud premium."

One of the innovations of this paper is to realize the "diagnosis" of the causes of "Amihud premium" by analyzing the different "symptoms" of "illiquidity compensation" and "mispricing." For example, if the mechanism for determining the expected return of stocks is "illiquidity compensation," the expected return of a portfolio with a smaller float market capitalization should be higher than that of a portfolio with a larger float market value, because small-cap stocks are less liquid. Will get more "illiquidity compensation"; if it is "mispricing," the expected return of the small-cap portfolio should be lower than that of the large-cap portfolio, because small-cap stocks are more prone to speculation, and the higher the degree of speculation, the future The lower the yield. The "mispricing" of large-cap stocks is easily corrected by the selling behavior of other rational investors who hold stocks. Therefore, by examining the relationship between the expected return of stocks in the high-Amihud portfolio and the low-Amihud portfolio and the float market value, this paper can judge whether the pricing mechanism of this portfolio is "illiquidity compensation" or "mispricing."

1.4 Main findings

1.4.1 Robust Amihud premium

First, this article uses monthly data from January 2007 to March 2018 to confirm that there is

a very robust "Amihud premium" in the A-share market. The impact of the Amihud indicator on expected stock returns has both economic and statistical significance across industries, months and subsample periods with varying investor sentiment, overall market liquidity, and uncertainty, or adjusted for various risk factors.

1.4.2 Amihud premium is driven by its component of traded volume

Then, this paper also refers to the ideas of Lou and Shu (2017) [1] and Amihud and Noh (2018) [2] to decompose the Amihud indicator into components related to volatility, transaction volume and the covariance of the two, and finds that volatility The prediction effect of components on stock returns is not obvious, while the components related to transaction volume are significantly correlated with future stock returns. In addition, this paper adds the Amihud indicator together with relative spread, quotation depth, transaction volume or turnover rate into the Fama-MacBeth regression model to conduct a "horse race," and finds that the Amihud indicator can capture the effect of high-frequency liquidity indicators on the expected stock returns impact, indicating that the Amihud indicator has a better effect on describing stock illiquidity, which is consistent with the conclusions of previous literature (Goyenko et al, 2009 [11]; Zhang Zheng et al, 2014 [12]). However, after controlling for transaction volume, Amihud's coefficient is no longer significant. This paper also conducts a "horse race" between the high-frequency version of the Amihud indicator and the transaction volume. The results show that the coefficient of the high-frequency Amihud indicator is not significant, or even negative, indicating that the Amihud indicator is only priced for the transaction volume component. Shu (2017) [1] has the same conclusion.

1.4.3 High-Amihud-portfolio's high return and low-Amihud-portfolio's negative return

The coefficient of Amihud in the regression model is positive, which can only mean that the return of high Amihud combination is higher than that of low Amihud combination. As for whether the high Amihud combination obtains a high return, or the low Amihud combination obtains a very low return, or maybe both occur at the same time, which needs to be further explored. Therefore, this paper examines the returns of ten investment portfolios divided by Amihud levels from low to high, and finds that the cumulative return of holding the high Amihud portfolio of the previous month keeps rising, while the cumulative return of holding the low Amihud portfolio of the previous month Yields continued to fall, with other portfolios yielding somewhere in between. In addition, after adjusting the returns of all stocks using the Fama-French five-factor model [13] [14], the upward trend of the cumulative return of the high Amihud portfolio is still very obvious, while

the cumulative return of the low Amihud portfolio is a straight line fell. At the same time, combined with the actual situation of the A-share market, this paper excludes hedging, the moral hazard of fund managers, and investor gambling, which can allow both "investor rationality" and "low Amihud portfolios to achieve negative returns" explanations, thus confirming that the low negative returns on Amihud's portfolio were caused by "mispricing."

1.4.4 The characteristics of high-Amihud-portfolio and low-Amihud-portfolio

Then, this paper also compares the differences between the high-Amihud portfolio and the low-Amihud portfolio in terms of yield, risk level, liquidity, valuation level, growth, asset size, analyst attention, information transparency, and shareholding concentration. The results show that high Amihud portfolios usually have many attributes that are unfavorable to investors, such as higher transaction costs, higher valuations, lower growth, smaller asset size, less analyst attention, lower information transparency and equity holdings The proportions are more spread out and so on. However, the high Amihud portfolio shows both higher returns and lower risk levels. In contrast, the low Amihud portfolio not only has a higher level of risk, but also has a lower yield, which supports the conclusion that the low Amihud portfolio is "mispriced."

1.4.5 Event-study analyses: the overreaction of low-Amihud-portfolio

In addition, this paper also uses the event study method to examine the return rate and turnover trend of the low-Amihud portfolio and the high-Amihud portfolio. The results found that although the portfolio with the lowest Amihud level in the previous month achieved negative returns in that month, it experienced a rapid increase in cumulative returns and turnover in the previous months, and the return skewness within the portfolio was also relatively high. However, from the negative returns recorded in the month, the cumulative returns and turnover continued to decline, and the return skewness within the portfolio also dropped to a lower level than the high Amihud portfolio. One possible explanation is that investors observed the phenomenon of high returns and high return skewness of the low-Amihud portfolio before, thus forming a wrong expectation of the return distribution of the low-Amihud portfolio, and began to trade the stocks of the low-Amihud portfolio, resulting in Low Amihud portfolio saw a surge in turnover. However, investors did not get the expected returns afterward, so the stock price continued to fall, while the turnover was gradually reduced. This result clearly shows that the negative returns of the low Amihud portfolio are caused by an "overreaction" by investors. In addition, investors trade stocks based on erroneous expectations of the stock's return distribution, resulting in losses, which is exactly what

"mispricing" means.

Contrary to the situation of the low Amihud portfolio, the high Amihud portfolio experienced a rapid decline in cumulative returns and turnover before obtaining positive excess returns in the current month. At the same time, the turnover has also gradually increased. This shows that investors may be reluctant to hold stocks whose stock prices and turnover have fallen rapidly, so holding these stocks can obtain excess returns as compensation, which is consistent with the interpretation of "illiquidity compensation."

1.4.6 Double-sorting analyses: the compensation for illiquidity or mispricing

In addition, this paper also combines a series of asset pricing theories and uses Double Sorting to analyze how the expected return of each portfolio grouped by Amihud level is affected by various variables such as float market capitalization, turnover rate and volatility. impact, thereby verifying or ruling out various possible explanations for the cause of the "Amihud Premium." Through bivariate ranking analysis, the relationship between stock expected return and two ranking variables, as well as the interaction between the two variables, whether these relationships are linear or nonlinear, can be visualized. The results show that in the portfolio with the highest level of Amihud, the stock return increases significantly with the increase of the relative spread, which is generally regarded as the best liquidity indicator (Goyenko et al, 2009) [11], which shows that There is a clear "illiquidity compensation" for the high Amihud portfolio. In addition, in the low Amihud portfolio, the expected return of the stock decreases significantly with the increase of turnover or volatility, which is consistent with the theoretical prediction of Scheinkman and Xiong (2003) [8], the turnover or volatility is related to the stock The level of speculation is positively correlated with the higher the level of speculation, the lower the subsequent rate of return.

There is another very interesting and important finding in this paper: in the high Amihud portfolio, the stock return decreases with the increase of the float market value, while in the low Amihud portfolio, the stock return increases with the increase in the float market value. This corresponds to the inferences of "illiquidity compensation" and "mispricing," respectively. In a high-Amihud portfolio, small-cap stocks are less liquid and therefore require higher returns as compensation; in a low-Amihud portfolio, small-cap stocks are more prone to speculation and therefore have lower future returns. The paper also finds that in high-Amihud portfolios, stock returns increase with the level of risk (measured by volatility, beta, and unsystematic risk, respectively), while in low-Amihud portfolios, the greater the risk, the greater the return. Low.

This result is consistent with the conclusion that there is a "mispricing" of the low Amihud portfolio. In addition, the article also points out that the reason for the high return of the high Amihud portfolio is not the repair after the stock price panic fell. In addition, the paper also uses the Fama French five-factor model to adjust the portfolio returns, and the results are consistent with the original, which consolidates the conclusion of this paper: "Illiquidity compensation" for high Amihud portfolios and "mispricing" for low Amihud portfolios The combined effect of the two constitutes the "Amihud premium" of the A-share market.

1.4.7 Amihud premium in time series

In addition to the "Amihud premium" in the cross section, Amihud (2002) [3] also analyzed the "Amihud premium" in the time series, and found that the current market return was significantly positively correlated with the expected illiquidity of the previous period, while the expected illiquidity is significantly negatively correlated, in which the expected illiquidity is measured by the fitted value of the market average Amihud index in the first-order autoregression, and the unexpected illiquidity is characterized by the residual part.

This paper points out that Amihud (2002) [3] used the full sample in estimating expected illiquidity, so expected illiquidity may contain information about the future returns of stocks, which would lead to endogeneity problems and bias the coefficient estimates. To eliminate this concern, this paper uses data from the past 60 months to estimate expected illiquidity and unexpected illiquidity on a rolling basis, and finds that expected illiquidity no longer has a significant predictive effect on market returns. Therefore, this paper believes that there is no "Amihud premium" in the time series in the A-share market.

1.4.8 Daily Amihud premium

Based on monthly data analysis, this paper also explores the relationship between the Amihud indicator and daily expected stock returns. It should be noted that the research on daily returns in this paper is not a simple repetition of the analysis of monthly returns, because the behavior of daily returns is very different from that of monthly returns. For example, daily returns are more affected by trading systems such as the price limit. The meaning of the "reversal effect" and "momentum effect" of daily returns is also very different from that of monthly returns. In addition, studying daily data can provide investors and regulators with a short-term microscopic view of stock return behavior, enabling more timely and targeted decisions.

This paper finds that the daily "Amihud premium" is very obvious, but after controlling the

transaction amount, the coefficient of the Amihud indicator of each frequency changes from significant to positive to insignificant, or even negative. This result once again proves that the "Amihud premium" is Driven by the volume component in the indicator.

Then, this paper finds that the cumulative return of holding the high Amihud portfolio on the previous trading day has continued to rise, while the cumulative return of the low Amihud portfolio has been falling (the samples such as the daily limit or ST have been excluded). In addition, after excluding the influence of individual stock heterogeneity and various risk factors, the yield differentiation of high-Amihud portfolio and low-Amihud portfolio is more obvious, the former keeps rising, while the latter plummets.

Further, this paper uses the event study method to analyze the cumulative returns and turnover trends of the low Amihud portfolio and the high Amihud portfolio before and after obtaining abnormal returns on that day. It was found that the low Amihud portfolio experienced a sustained and rapid rise in cumulative returns and turnover before posting negative returns on the day. Subsequently, the cumulative yield and turnover reversed downward and continued to decline. This result once again suggests that the negative returns of the low Amihud portfolio are caused by an "overreaction" by investors.

1.5 Main Contributions

Through a detailed empirical analysis, this paper resolves the debate on whether the "Amihud premium" is caused by "illiquidity compensation" or "mispricing," which contributes greatly to the literature and provides many useful insights for the practice community.

First, through the “horse race” between Amihud indicators and transaction volume at various frequencies, this paper confirms that the Amihud indicator is only priced as the transaction volume component, which directly answers the key question in the debate on the cause of the “Amihud premium.” Second, this paper points out the fact that the return of the low Amihud portfolio continues to be negative, providing direct evidence of the “mispricing” of the low Amihud portfolio. Third, through event research analysis, this paper points out that “overreaction” is the reason for the negative returns of low Amihud portfolios, a finding that complements the empirical evidence on “mispricing” in the literature. In addition, combined with a series of asset pricing theories, this paper summarizes the idea of using bivariate ranking method to identify "illiquidity compensation" and "mispricing.” This paper finds that the expected return of high Amihud

portfolio is determined by "illiquidity compensation," while the low Amihud portfolio is "mispricing," and the combined effect of the two contributes to the "Amihud premium" in the A-share market, which is similar to that of the Amihud portfolio. The previous literature "either or the other" has different conclusions. Finally, the paper also uses daily data for analysis to expand the microscopic perspective on the formation mechanism of the "Amihud Premium," which is of great benefit to academic researchers, financial market participants and policy makers to understand the short-term behavior of stock returns and the market microstructure.

2. Literature Review

2.1 The thread to sort out the literature

Scholars have organized literature reviews on liquidity and asset pricing from multiple perspectives. Among them, Shi Yongdong and Yuan Shaofeng (2011) [15] reviewed the important literature on illiquidity premium from three aspects: basic theory, micro-foundation and empirical method. Zhang Yulong and Li Yizong (2013) [16] pointed out that a development direction of liquidity related literature is to study liquidity from the perspective of systemic risk. Wan Xiaoyuan and Yang Chaojun (2017) [17] summarized the literature on liquidity risk. In addition, Wang Yanjie and Luo Gangqing (2017) [18] summarized the literature on illiquidity premium, liquidity shock and stock price volatility.

Different from the perspective of previous literature review, this paper uses the debate on the reasons for the pricing of illiquidity indicators in Amihud (2002) [3] as a clue and sorts out the domestic and foreign theories on "illiquidity premium" and "mispricing" Empirical literature and points out the link between the two types of literature.

2.2 The invention and application of Amihud measure

Amihud (2002) [3] proposed to use the annual average of the ratio of the absolute value of the daily rate of return to the daily turnover to measure the stock illiquidity and found that this indicator has a significant impact on the cross-sectional difference of stock returns and the overall market return in Changes in the time series have significant explanatory effects.

The Amihud indicator is widely used in empirical research on the illiquidity premium. More representatively, Amihud et al (2015) [4] found that most of the stock markets in 45 countries around the world have illiquidity premiums, and the illiquidity premiums in each country will

increase or decrease at the same time. In addition, Amihud (2018) [19] reviewed the situation in which the Amihud indicator was priced from 1964 to 2017 and pointed out that the return difference between the high Amihud portfolio and the low Amihud portfolio was still significant after controlling for the Carhart four factors. In terms of the Chinese market, Wu Wenfeng et al. (2003) [20] first found that there is "illiquidity compensation" in the Chinese A-share market and pointed out that it is more obvious in small-cap stocks. Liang Lizhen and Kong Dongmin (2008) [21] also came to a similar conclusion. Su Dongwei and Mai Yuanxun (2004) [22], Huang Feng and Yang Chaojun (2007) [23] also studied the illiquidity premium in the A-share market.

2.3 The potential factors affecting Amihud premium

The "Amihud Premium" may be affected by a variety of market environment factors. Baker and Wurgler (2006) [24] argue that many stock return premiums depend on investor sentiment, including the illiquidity premium. Pastor and Stambaugh (2003) [25] pointed out that the illiquidity premium should be larger when the market is illiquid, because investors will pay more attention to stock liquidity. Zhang (2006) [26] believes that information uncertainty will affect the expected stock return. McLean and Pontiff (2016) [27] pointed out that the publication of academic papers may weaken or even disappear various premium phenomena. In addition, Eleswarapu and Reinganum (1993) [28] and Hasbrouck (2009) [29] found that the illiquidity premium is only significant in January.

2.4 The debate about the causes of Amihud premium

At present, the formation mechanism of the "Amihud premium" is still controversial in the academic circles. The usual view is that the "Amihud premium" comes from compensating for the illiquidity of stocks because liquidity is valuable to investors (Amihud and Mendelson, 1986[30]; Amihud, 2002[3]; Amihud et al, 2015 [4]). However, the literature points to evidence against the "illiquidity compensation" interpretation. Among them, Brennan et al (2013) [31] decomposed the Amihud indicator into two parts according to the positive and negative returns and found that only the parts with negative returns were priced.

In addition, using the monthly average of the reciprocal daily trading volume can also get results that are very close to the Amihud indicator, so the "Amihud premium" is driven by the trading volume component in the indicator, and the impact of trading volume on stock expected

returns is proven Source for “mispricing” rather than “illiquidity compensation” (Lou and Shu, 2017[1]). After that, Harris and Amato (2018) [5] and Drienko et al (2018) [32] reproduced and extended the research of Amihud (2002) [3], respectively. Among them, Harris and Amato (2018) [5] found that the “Amihud premium” weakened a lot after 1997, which is consistent with the findings of Ben-Rephael (2015) [33].

In addition, using a relatively simple indicator (the ratio of the mean absolute value of daily returns to the mean daily turnover) yields similar results to those reported by Amihud (2002) [3]. In addition, Drienko et al (2018) [32] pointed out that the effect of expected illiquidity on market returns is no longer significant outside the sample of Amihud (2002) [3].

On the other hand, Amihud and Noh (2018) [2] provided feedback on the study of Lou and Shu (2017) [1], pointing out that it missed the covariance related to stock volatility and trading volume when decomposing the Amihud indicator Part (DIF), and found that DIF has a significant positive correlation with the expected stock return in the cross section, and also has a certain explanatory power to the changes in the overall market return in the time series. Since then, Lou and Shu (2018) [6] responded to Amihud and Noh (2018) [2], pointing out that DIF is negatively correlated with stock illiquidity, while DIF is significantly positively correlated with stock expected return, which is related to "illiquidity" Premium" has the opposite effect. The results of Amihud and Noh (2018) [2] just show that the Amihud indicator only measures the part of stock illiquidity that is related to transaction volume.

2.5 The focus of the debate: Is Amihud premium driven by its volume component?

The debate over the cause of the "Amihud premium" is not about the effective effect of the Amihud metric in measuring stock illiquidity, but rather about what is priced in the Amihud metric.

Numerous literatures have reached a consensus on the effectiveness of the Amihud indicator in measuring stock illiquidity. As described by Amihud (2002) [3], although the Amihud indicator only uses daily data, it has a high correlation with high-frequency liquidity indicators. Goyenko et al. (2009) [11] compared a series of high-frequency and low-frequency liquidity indicators using US market data and concluded that the Amihud indicator can effectively measure stock illiquidity. In addition, Zhang Zheng et al. (2014) [12] obtained similar analysis results using the data of the A-share market. Even Lou and Shu (2017) [1] agree on the superiority of the Amihud indicator in measuring illiquidity.

A key question in the debate between Amihud and Noh (2018) [2] and Lou and Shu (2017) [1] is: Is the impact of the Amihud indicator on expected returns driven by the transaction volume component? Bernnan et al (1998) [34], Datar et al (1998) [35] and Chordia et al (2001) [36] found a negative correlation between transaction volume and expected returns. Lou and Shu (2017) [1] argue that only the trading volume component of the Amihud indicator has an impact on expected returns, while Amihud and Noh (2018) [2] emphasize that the covariance of trading volume and volatility is also priced.

This question is important because the effect of transaction volume on a stock's expected return is usually related to a variety of factors other than liquidity. Among them, Harris and Raviv (1993) [37], Blume et al (1994) [38] and Kandel and Pearson (1995) [39] believe that transaction value measures the degree of investor disagreement. Lee and Swaminathan (2000) [40] emphasized that "transaction premium" is related to investors' behavior of value investing. Gervais et al (2001) [41] found that extremely high trading volumes increase the level of attention and therefore subsequent returns to the stock. Additionally, Jiang et al (2005) [42] and Barinov (2014) [10] argue that the “turnover effect” is caused by uncertainty, not liquidity. Zhang Zheng and Liu Li (2006) [9] emphasized that the "turnover effect" is caused by speculative bubbles. If only the transaction value component of the Amihud indicator is priced, then the "Amihud premium" is likely to be related to "mispricing" based on previous literature findings.

2.6 The theoretical research related to mispricing

In order to test the explanation of "mispricing" in combination with asset pricing theory, this paper also sorts out the literature in this area. Allen and Gorton (1993) [43] and Allen and Gale (2000) [44] pointed out that the moral hazard problem of fund managers may cause stocks to trade at prices well above their fundamental value. In addition, Barberis and Huang (2008) [45] believed that investors would buy stocks as lottery tickets, which would lead to overpriced stocks with positive return skewness, and thus expected negative returns.

Short selling constraints and heterogeneous beliefs among investors are often cited as two preconditions for "mispricing.” Miller (1977) [46] argues that in the presence of short selling constraints, trading by optimistic investors can overprice stocks. Harrison and Kreps (1978) [47] built a model to prove that if there is a short selling constraint and investors have different judgments on the fundamentals of the company, then the stock price will be biased towards the

valuation of optimistic investors, because pessimistic investors cannot pass Sell short to express your opinion. Scheinkman and Xiong (2003) [8] argue that overconfident investors will place more value on information that is consistent with their views, while ignoring facts they don't like, resulting in "mispricing" of stocks, and the degree of "mispricing" varies with the exchange rate Lot or volatility is positively correlated. In addition, Hong et al (2006) [48] proved that an increase in the number of outstanding shares will inhibit the formation of asset price bubbles, because the more shares in circulation, the more pessimistic investors will sell what they think are overpriced stocks, thereby offsetting the effects of "mispricing." Baker and Stein (2004) [7] argue that in the presence of short selling constraints, high liquidity means that the market is dominated by irrational investors, so the subsequent returns will be lower.

In addition, Hong and Stein (1999) [49] proposed a theory that can explain investor underreaction, momentum trading and overreaction at the same time, and pointed out that the carry trade of momentum traders is an important reason for the occurrence of overreaction. The model of Hong and Stein (2003) [50] explains the relationship between investor heterogeneous beliefs, short selling constraints, and stock market crashes, and predicts that periods of high trading volume are followed by greater negative skewness in returns. Hong and Stein (2007) [51] provide an overview of investor divergence and mispricing.

2.7 The empirical studies about mispricing

In addition to the theory on "mispricing," this paper also collate related empirical research. Baker and Wurgler (2006) [24] believed that "mispricing" was caused by uninformed investors' demand shocks for stocks under the condition of arbitrage constraints and found that stocks with a high degree of arbitrage constraints (such as small market capitalization, illiquid stocks) will be more affected by investor sentiment. Stambaugh et al (2012) [52] found that after periods of high investor sentiment, the premium of many buy-short portfolios constructed according to stock characteristics is more pronounced, which is caused by the overpricing of short portfolios of.

There are also literatures analyzing "mispricing" in China's financial markets. Zhang Zheng and Liu Li (2006) [9] believe that in the A-share market, the turnover rate is positively related to the degree of speculation in the stock. The greater the degree of speculation, the greater the bubble component of the stock price, so the subsequent return will be lower. In addition, Xiong and Yu (2011) [53] analyzed the reasons why warrants were significantly higher than theoretical value in

2005-2008, and tested a series of theories related to "mispricing," pointing out short selling constraints and investor heterogeneity Belief is an important factor in the formation of the warrant bubble. Han Gan and Hong Yongmiao (2014) [54] found that institutional investors took advantage of the overreaction of retail investors to industrial policy announcements to profit and pointed out the phenomenon of "return rate inversion" before and after industrial policy announcements. In addition, Li Xindan et al. (2014) [55] found that individual investors would overreact to listed companies' "high delivery and transfer" policies, resulting in investment losses.

2.8 The differences between this paper and other literature

Compared with the previous literature, the research in this paper has the following unique features. First, this paper re-analyzes Amihud's (2002) [3] analysis on illiquidity premium using A-share data, and conducts research by industry, period, and month, and points out that "illiquidity compensation" only occurs when liquidity These findings enrich the factual details about the illiquidity premium in the A-share market.

In addition, this paper finds that the impact of the Amihud indicator and its high-frequency version on stock expected returns is driven by the transaction volume component. This result supports the conclusion of Lou and Shu (2017) [1]. The debate provides new evidence.

This paper also combines the asset pricing theory to provide ideas for distinguishing the two mechanisms of "illiquidity compensation" and "mispricing," and points out that the two mechanisms of "illiquidity compensation" and "mispricing" coexist in the A-share market, rather than an "either-or" relationship. The reason why the previous literature analysis of the formation mechanism of the illiquidity premium may get different answers may be because only part of the facts is observed. The findings of this paper to some extent reconcile inconsistent conclusions from past studies.

Then, based on the study of Lou and Shu (2017) [1], this paper points out the fact that the return of the low Amihud portfolio or the high transaction volume portfolio in the previous period continued to be negative, and after adjustment for various risk factors, it remained as such, this complements the direct evidence on "mispricing" in the literature. Zhang Zheng and Liu Li (2006) [9] found that after controlling for the Amihud indicator, the turnover rate and expected return were still significantly negatively correlated, and thus concluded that the "turnover rate effect" originated from "mispricing." This paper acknowledges that this conclusion is reasonable, however,

the negative coefficient of turnover ratio may also be because the turnover ratio characterizes different aspects of stock liquidity, so this result cannot completely rule out the explanation of the "illiquidity premium.” In addition, the negative regression coefficient of turnover rate can only indicate that the return rate of the portfolio with high turnover rate is lower, and it does not necessarily mean that its rate of return is negative. Therefore, persistently negative portfolio returns are more direct and convincing evidence of “mispricing” than negative regression coefficients. In addition, this paper also excludes possible explanations such as "hedging,” "moral hazard of fund managers" and "gambling behavior,” which consolidates the conclusion that there is "mispricing" in the low Amihud portfolio.

The paper also points out, through event research analysis, that negative returns on low Amihud portfolios or high trading value portfolios come from an “overreaction” by investors, as stocks in these portfolios typically experience rapid increases in share price and trading value before negative returns. This finding validates theories about "mispricing" and provides new insights into the causes of the illiquidity premium.

In addition to pointing out the phenomenon of "overreaction" in low Amihud portfolios, this paper also incorporates a series of asset pricing theories based on short selling constraints and investor heterogeneity beliefs (Harrison and Kreps, 1978[27]; Hong and Stein, 1999[49]; Scheinkman and Xiong, 2003[8]; Hong et al, 2006[48]) to analyze the influencing factors of low Amihud portfolio returns, verifying several core inferences of these theories, and emphasizing that the short-selling constraint is the cause of a key condition for "mispricing" in the A-share market.

In addition, this paper explores the short-term "Amihud premium" using daily data from the A-share market, providing a fresh perspective on the short-term behavior of stock returns. This paper finds that the positive impact of the Amihud indicator and its high-frequency version on the expected daily stock returns is driven by the trading volume component in the indicator, which expands the previous literature's understanding of the short-term illiquidity premium in the A-share market and clarifies the priced components of the Amihud indicator. In addition, the article highlights that holding a low Amihud portfolio or a high trading value portfolio from the previous trading day will continue to make negative returns and points out that this is caused by the "overreaction" of investors, which provides new evidence for the economics theories of "mispricing.”

3. The Analyses of Monthly Amihud Premium: A Tale of Two Mechanisms

3.1 Sample selection, descriptive statistics, and the matrix of correlation coefficients

3.1.1 Sample selection

The sample selected in this paper is the monthly data of all A shares from January 2007 to March 2018. During this period, the A-share market has experienced periods when stock prices continued to fall and market liquidity dried up during the subprime mortgage crisis in 2008, and there were also periods in early 2015 when stock prices and transaction volumes rose rapidly and market liquidity was abundant. In addition, the liquidity between different stocks shows huge differences. Therefore, for the study of "Amihud premium," which is closely related to changes in stock liquidity, the sample selected in this paper is highly representative.

The high-frequency liquidity indicators used in this article, such as relative spread, quotation depth, high-frequency version of the Amihud indicator, realized volatility, etc., are calculated based on the tranche or minute data of Guotai'an (GTA) CSMAR high-frequency database. The specific calculation steps are provided in the appendix to this article.

In addition, the characteristic variables of listed companies, including monthly return, Amihud index, circulating market value, book-to-market value ratio, monthly transaction volume, monthly turnover rate, financial characteristics, auditor type, analyst attention and shareholding concentration, etc. Investor sentiment index, Pastor-Stambaugh market liquidity index, risk-free interest rate, etc. are derived from the CSMAR database or calculated based on the CSMAR database. Regarding variable definitions, the GTA CSMAR database website provides very detailed instructions.

3.1.2 Descriptive Statistics

From the descriptive statistical results reported in Table 1, the average monthly rate of return is 1.9%, but the standard deviation of the monthly rate of return reaches 19.2%, and the corresponding continuous compound rate of return (average percentage rate of return - variance/2) is only 0.0568%, which is consistent with the fact that the A-share market index rose less during the period studied in this article. The sample with the largest decline was -75.3%, while the sample with the largest gain was up 22 times in a month.

The circulating market value of different stocks also shows a large gap. During the sample period, the average circulating market value of A shares was 9.6 billion, while the standard deviation reached 45.3 billion, nearly 5 times the average value. Among them, the smallest

circulating market value is only 61 million, while the largest exceeds 2 trillion. In addition, the sample average book-to-market ratio is 0.356, the return over the past month is 1.8%, and the cumulative return over the past two to twelve months is 21.4%.

In terms of turnover rate and transaction volume, the A-share market has shown high activity, with an average monthly turnover rate of 62% and a transaction volume of nearly 3 billion. However, there are huge differences in transaction activity among different stocks. The smallest monthly turnover rate is close to 0, the largest can reach 11 times, the smallest monthly transaction volume is less than 20,000 yuan, and the largest is 568 billion (CITIC Securities recorded this transaction volume in December 2014).

Relative spread is a high-frequency liquidity indicator that directly measures the cost of stock trading. From January 2007 to March 2018, the average relative spread was 0.15%, which was lower than the value (0.27%) obtained by Zhang et al. (2014) using data from 1999 to 2009, which may be Because A-shares have experienced periods of relatively good liquidity in recent years, the relative spread is relatively small on average. There is a very large gap in the relative spread between samples, the smallest is only 0.02%, while the largest is close to 1.4%. The first-level quotation depth is the amount that can be traded at one price or one price immediately. The average value of the sample is 283,000 yuan, while the smallest is less than 2,000 yuan, and the largest is more than 400 million yuan. The average depth of quotations for the fifth grade is 1.83 million yuan, which is about 6 times that of the first grade, but the smallest is less than 10,000 yuan, and the largest is close to 1.6 billion.

From the Amihud index of each frequency, the mean value of the Amihud index increases with the increase of the calculation frequency. In addition, the standard deviation of the Amihud indicator with a frequency from 5 minutes to a day is relatively close, about 1.3; the standard deviation of the Amihud indicator with a frequency of 3 seconds and 1 minute is smaller, about 1.1.

Table 1: Descriptive Statistics of Main Variables for Monthly Data

Variable	Abbreviation	Obs	Mean	Std	Min	Max
Monthly Excess Return	R-rf	296,009	0.019	0.192	-0.753	22.051
Circulating Market Cap (Million Yuan)	Mv	298,309	9,563	45,300	61.392	2,170,000
Book to Market Ratio	Bm	285,833	0.356	0.254	3.520E-05	9.655
Return in Month -1	R1lag	290,309	0.018	0.192	-0.753	22.051
Return from month -12 to -2	R12lag	235,724	0.214	0.722	-0.890	32.282
Monthly Trading Days	Nday	298,309	19.593	3.314	1.000	23.000
Turnover	Turnover	298,309	0.620	0.691	3.540E-05	11.224
Trading Volume (Ten Thousand Yuan)	Trade	298,309	299,000	681,000	1.742	56,800,000
Realized Volatility of 5-min Frequency	Rv05m	298,252	0.028	0.012	0.000	0.546
Relative Bid-Ask Spread (%)	Rpd	296,324	0.154	0.073	0.021	1.378
Best Quote Order Depth (Ten Thousand Yuan)	Depth1	296,324	28.296	149.327	0.172	40,400
Best Five Quote Order Depth (Ten Thousand Yuan)	Depth2	296,324	183.374	670.613	0.931	157,000
Amihud Indicator of 3-sec Frequency	Amihud3s	296,323	-15.940	1.110	-23.223	-9.909
Amihud Indicator of 1-min Frequency	Amihud01m	297,292	-18.692	1.114	-32.409	-13.025
Amihud Indicator of 5-min Frequency	Amihud05m	297,303	-19.656	1.325	-32.673	-12.838
Amihud Indicator of 10-min Frequency	Amihud10m	297,298	-20.180	1.306	-32.093	-12.433
Amihud Indicator of 15-min Frequency	Amihud15m	297,292	-20.476	1.285	-31.739	-12.396
Amihud Indicator of 30-min Frequency	Amihud30m	297,281	-20.966	1.254	-31.135	-12.109
Amihud Indicator of 60-min Frequency	Amihud60m	297,391	-21.441	1.252	-35.220	-12.886
Amihud Indicator of daily Frequency	Amihud_daily	298,306	-21.820	1.304	-27.437	-9.600

Note: All return figures in the table are deducted from monthly risk-free returns, and each frequency Amihud indicator is reported as a logarithmic value.

3.1.3 The matrix of correlation coefficients

Table 2 reports the correlation coefficient matrix of the Amihud indicator with market capitalization, turnover, trading volume, realized volatility, and high-frequency liquidity indicators. The Amihud indicator of daily frequency is the indicator used in the original text of Amihud (2002) [3]. It has a higher correlation coefficient with other Amihud indicators of frequency calculation in this paper, and the closer the frequency is, the higher the degree of correlation. Among them, the Amihud indicator of 5-minute frequency has a correlation coefficient with the Amihud indicator at 30-minute frequency is as high as 0.987.

Table 2: Correlation coefficient matrix of Amihud indicator and other variables

	A_daily	A3s	A05m	A30m	Mv	Turnover	Trade	Rv05m	Rpd	Depth1	Depth2
A_daily	1.000										
A3s	0.577	1.000									
A05m	0.838	0.728	1.000								
A30m	0.853	0.687	0.987	1.000							
Mv	-0.279	-0.129	-0.254	-0.270	1.000						
Turnover	-0.077	-0.351	-0.236	-0.205	-0.094	1.000					
Trade	-0.477	-0.482	-0.524	-0.522	0.324	0.187	1.000				
Rv05m	0.107	-0.142	-0.020	0.018	-0.079	0.447	0.184	1.000			
Rpd	0.562	0.749	0.651	0.620	-0.053	-0.218	-0.230	0.155	1.000		
Depth1	-0.174	-0.002	-0.150	-0.174	0.288	-0.029	0.161	-0.039	0.086	1.000	
Depth2	-0.260	-0.015	-0.229	-0.258	0.379	-0.047	0.261	-0.069	0.100	0.940	1.000

Note: Amihud is abbreviated as A for the sake of simplicity.

In addition, the Amihud indicator has a negative correlation with the circulating market value, turnover rate and transaction volume, of which the correlation coefficient with the transaction value is the highest, reaching -0.477, followed by the circulating market value, which is -0.279, and the correlation coefficient with the turnover rate The lowest, only -0.077. However, with the increase of calculation frequency, the correlation between Amihud and turnover rate gradually increased, and the correlation coefficient between the 3-second version of Amihud indicator and turnover rate reached -0.351.

The correlation coefficient between the realized volatility (Rv05m) of the 5-minute frequency and Amihud_daily is 0.107, but with the increase of the calculation frequency of the Amihud indicator, the relationship between Rv05m and the Amihud indicator turns negative, and the correlation between Rv05m and the Amihud indicator of the 3-second frequency The coefficient

is -0.142.

In addition, the correlation coefficient between the Amihud indicator and the relative spread is high, reaching 0.562, and it increases with the increase of the calculation frequency. The correlation coefficient between the relative spread and the 3-second version of the Amihud indicator rises to 0.749. The quotation depth is negatively correlated with the Amihud indicator. The correlation between the five-level quotation depth and Amihud (-0.260) is greater than the first-level quotation depth (-0.174). In addition, unlike the relative spread, as the calculation frequency increases Increase, the correlation between Amihud and quotation depth shows a downward trend. The correlation coefficient of Amihud with a frequency of 3 seconds and the depth of quotations is only -0.002.

3.2 Research design and empirical results

3.2.1 The setting of Fama-MacBeth regression

Referring to Amihud and Noh (2018) [2], this paper adopts the two-step method of Fama and MacBeth (1973) [57] to analyze the cross-sectional returns of stocks, first performing cross-sectional regression of stock excess returns on stock characteristics each month, The coefficient estimate time series will then be averaged and statistically tested using Newey-West heteroskedastic autocorrelation robust standard errors [58] with lag 6. The benchmark model set in this paper is as follows:

$$\left(R_j - r_f\right)_s = b0_s + b1_s * Amihud_{j,s-2} + b2_s * Me_{j,s-2} + b3_s * Bm_{j,s-1} + b4_s * R1lag_{j,s-1} + b5_s * R12lag_{j,s-2} + error_{j,s},$$

where $Amihud_{j,s-2}$ represents the illiquidity indicator proposed by Amihud (2002) [3], where the subscript j represents the stock, the subscript s represents the month; $\left(R_j - r_f\right)_s$ is the stock j in The excess rate of return in month s is obtained by subtracting the risk-free interest rate (monthly one-year fixed deposit rate) from the rate of return of stock j considering dividend reinvestment in month s. The control variables selected in this paper are as follows: (1) $Me_{j,s-2}$ is the logarithm of the market value of stock j in s-2 months; (2) $Bm_{j,s-1}$ is the logarithm of the book-to-market ratio of stock j in the s-1 month, where the book-to-market ratio is calculated by first dividing the total stock market value of stock j on each trading day in the s-1 month by the net assets in the latest reporting period , then average by month; (3) $R1lag_{j,s-1}$ is the return of stock j in month s-1,

which is used to describe the "reversal effect" of stock return; (4) $R12lag_{j,s-2}$ is the 11-month cumulative return of stock j from the s-12th month to the s-2th month, which is used to measure the "momentum effect" of stock returns. A large number of literatures have proved that the control variables selected in this paper have significant explanatory power on the stock cross-sectional return differences. In addition, all control variables in this paper are lagged relative to the explained variable $\left(R_j - r_f\right)_s$, among which $Amihud_{j,s-2}$ and $Me_{j,s-2}$ lag two months , in order to avoid a direct impact of recent changes in these variables on $R_{j,s}$, which is also done by Amihud et al (2015) [4] and Lou and Shu (2017) [1].

3.2.2 Amihud premium in the subsamples

In this paper, the Fama-MacBeth regression of stock excess return on the control variable is carried out first, and then the Amihud indicator, which is the focus of this paper, is added to the model. In addition, this paper also divides the sample into two sub-periods: the first part is from January 2007 to June 2012, and the second part is from July 2012 to March 2018. Then, this paper uses samples from two sub-periods to perform Fama-MacBeth regression to examine whether the "Amihud premium" of the A-share market increases or decreases over time. The regression results are summarized in Table 3.

From the regression equation (1) with only control variables added in Table 3, the coefficient of circulating market capitalization is significantly negative at the level of 1%, which indicates that there is an obvious "small market capitalization effect" in the A-share market, and the average return of small market capitalization stocks higher than large-cap stocks. The book-to-market coefficient is positive and significant at the 10% level, suggesting that value stocks, on average, have higher returns than growth stocks, which is similar to the situation in the U.S. market. In addition, the coefficient of R1lag is significantly negative at the level of 1%, indicating that there is a "reversal effect" in the A-share market. The higher the return in the past month, the lower the expected return of the stock. The regression coefficient of R12lag is negative or insignificant, indicating that the stock returns in the past 2 to 12 months have no significant relationship with the current returns. The empirical results are different.

Table 3: Periodic Fama-MacBeth regression results

	Only Controls	Full Sample	2007.1-2012.6	2012.7-2018.3
Dep: R-rf	(1)	(2)	(3)	(4)
Amihud_daily		0.00661***	0.00644***	0.00676***
		(6.385)	(3.553)	(6.463)
Me	-0.00534***	-0.000717	-0.000332	-0.00109
	(-2.938)	(-0.366)	(-0.125)	(-0.379)
Bm	0.00255*	0.00256*	0.00296*	0.00219
	(1.904)	(1.947)	(1.853)	(1.053)
R1lag	-0.0662***	-0.0676***	-0.0709***	-0.0645***
	(-6.455)	(-6.539)	(-5.560)	(-3.971)
R12lag	-0.00557	-0.00372	-0.0119	0.00406
	(-0.985)	(-0.642)	(-1.167)	(0.926)
Constant	0.0977***	0.173***	0.160***	0.185***
	(3.048)	(5.257)	(3.706)	(3.770)
Obs	232,695	232,695	94,404	138,291
R-squared	0.075	0.083	0.076	0.089
Groups	135	135	66	69

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively.

This article focuses on the coefficients of Amihud_daily. Amihud_daily refers to the Amihud index calculated with daily data, which is consistent with the calculation method proposed by Amihud (2002) [3]. Later in this article, the Amihud index will be calculated with multiple frequencies between 3 seconds and 60 minutes, so the original Amihud index will be marked as Amihud_daily as a distinction. In the full sample regression, the coefficient of Amihud_daily is positive and significant at the 1% level. After adding Amihud_daily to the regression model, the coefficient of circulating market capitalization becomes insignificant, which indicates that Amihud_daily can explain the "small market capitalization effect." The circulating market capitalization itself is also a liquidity indicator. Stocks with large market capitalization are usually more liquid, so it is reasonable that the Amihud indicator can capture the components that are priced in the circulating market capitalization. In addition, in the regression of the whole sample, the coefficient of Amihud_daily (take the logarithm) is 0.0066, and the 90% quantile of Amihud_daily is increased by 373% compared with the 50% quantile, which means that if the stock's Amihud_daily indicator changes from Raising the 50% quantile to the 90% quantile will increase the monthly expected return by 2.46% (0.0066*373%), which is a very impressive return. Therefore, Amihud's coefficients are both economically and statistically significant. In addition,

in the two sub-sample periods, the coefficients of Amihud_daily are significantly positive at the 1% level, and the coefficients are relatively close, indicating that the "Amihud premium" of the A-share market has not decayed over time.

This article then examines the differences in the “Amihud premium” of the A-share market across industries. The relationship between stock liquidity and expected stock returns may be related to the industry of the listed company. Fang et al (2014) [59] pointed out that the improvement of stock liquidity will inhibit corporate innovation, and innovation output is closely related to the company's long-term competitiveness, so it may affect future stock returns. In addition, corporate mergers and acquisitions may also lead to a negative relationship between stock liquidity and future stock returns. When a potential acquirer buys the stock of the target company in the secondary market, the stock liquidity will decrease. The stock price of the acquiring company will rise sharply. This also explains the positive correlation between the Amihud indicator and the future returns of stocks. If the "Amihud premium" in the A-share market is dominated by corporate innovation or corporate mergers and acquisitions, then the "Amihud" premium should mainly exist in industries that are highly dependent on innovation or where mergers and acquisitions frequently occur, such as high-tech industries. To verify this explanation, this paper conducts Fama-MacBeth regressions in six major industries (the GTA industry classification), including finance, utilities, real estate, general, industrial, and commerce. The sample size of each industry is between 6,000 and 160,000. time, which ensures that each industry has enough samples to estimate the coefficients of the model.

The empirical results in Table 4 show that in the regressions of the six industries, the coefficients of Amihud_daily are all positive. Except for the financial industry, the coefficients of Amihud_daily in other industries are all significant at the 1% level. Among them, the coefficient of Amihud_daily of the financial industry is the smallest, which is 0.004; the coefficient of the comprehensive industry is the largest, exceeding 0.014; the coefficient of other industries is around 0.006, which is close to the overall level. This shows that the "Amihud premium" generally exists in various industries where A-share listed companies are located, thus ruling out the possibility that the "Amihud premium" is dominated by the aforementioned corporate innovation and mergers and acquisitions.

Referring to the analysis ideas of Avramov et al (2017) [60], this paper compares the differences of the “Amihud premium” in different periods of investor sentiment, market liquidity

and uncertainty.

Table 4: Fama-MacBeth regression results by industry

	Full Sample	Finance	Utilities	Real Estate	General	Industrial	Commercial
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Amihud_daily	0.00661***	0.00418	0.00603***	0.00655***	0.0144***	0.00667***	0.00644**
	(4.688)	(1.307)	(3.051)	(3.750)	(3.771)	(4.438)	(2.568)
Me	-0.000717	-0.000905	-0.00324	-0.000779	0.00652*	-0.000990	-0.00108
	(-0.330)	(-0.327)	(-1.241)	(-0.285)	(1.668)	(-0.444)	(-0.368)
Bm	0.00256*	0.00902**	0.00135	0.00386**	0.0102***	0.00202	0.00433**
	(1.791)	(2.163)	(0.628)	(2.068)	(2.794)	(1.378)	(2.280)
R1lag	-0.0676***	-0.0712**	-0.0795***	-0.0851***	-0.0763***	-0.0666***	-0.103***
	(-6.874)	(-2.535)	(-6.704)	(-5.082)	(-3.791)	(-6.573)	(-7.761)
R12lag	-0.00372	-0.0121	-0.00537	-0.00903*	-0.00742	-0.00252	-0.00802
	(-1.053)	(-1.403)	(-1.329)	(-1.957)	(-1.372)	(-0.678)	(-1.429)
Constant	0.173***	0.134**	0.195***	0.174***	0.250***	0.177***	0.172***
	(5.610)	(2.390)	(5.518)	(3.805)	(5.140)	(5.521)	(4.534)
Obs	232,695	6,230	33,506	18,271	7,465	151,142	16,081
R-squared	0.083	0.314	0.122	0.134	0.174	0.084	0.123
Groups	135	135	135	135	135	135	135

Note: The t values calculated using the common standard error are in brackets, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively.

The "Amihud Premium" may be affected by investor sentiment in the market as a whole. The investor sentiment index CSCSI adopted in this paper is obtained from the GTA CSMAR database with reference to the calculation methods of Baker and Wulgler (2006) [24] and Yi Zhigao and Mao Ning (2009) [61]. The overall liquidity of the market is measured by the liquidity measure proposed by Pastor and Stambaugh (2003) [25]. In addition, market uncertainty is characterized by the realized volatility of the CSI 300 Index. This paper divides the sample into two sub-sample periods according to the median of the above three indicators, and then uses the sub-sample to perform Fama-MacBeth regression.

The results in Table 5 show that the coefficient of Amihud_daily is larger in periods of high investor sentiment than in periods of low investor sentiment, and according to the interpretation of Stambaugh et al (2012) [52], a greater degree of "Mispricing," this result shows that "Amihud premium" is likely related to "mispricing." However, in both sub-periods, the coefficient of Amihud_daily is significant at the 5% level, indicating that changes in the overall market sentiment cannot fully explain the "Amihud premium" in the A-share market. In addition, when the overall

liquidity of the market is good, the Amihud premium is slightly larger, but the gap between the Amihud coefficients in the low-liquidity period and the high-liquidity period is not obvious. Also, the "Amihud Premium" is slightly higher in times of greater uncertainty, but the difference is small. Overall, the coefficients of Amihud_daily are positive and significant at the 5% level in each subsample period. This shows that the overall investor sentiment, liquidity and uncertainty in the market have a certain impact on the "Amihud Premium," but they are not the dominant factors of the "Amihud Premium."

Table 5: Fama-MacBeth regression results for each subsample

	Low Sentiment	High Sentiment	Low Liquidity	High Liquidity	Low Uncertainty	High Uncertainty
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)
Amihud_daily	0.00552**	0.00781***	0.00630***	0.00687***	0.00638***	0.00683***
	(2.412)	(5.040)	(3.274)	(3.355)	(3.808)	(3.007)
Me	-0.00280	0.00159	-0.000695	-0.000736	0.00339	-0.00476
	(-0.828)	(0.603)	(-0.267)	(-0.217)	(1.419)	(-1.336)
Bm	0.00305*	0.00203	0.00122	0.00374*	0.00376**	0.00139
	(1.685)	(0.893)	(0.714)	(1.676)	(2.148)	(0.613)
R1lag	-0.0862***	-0.0470***	-0.0738***	-0.0623***	-0.0474***	-0.0876***
	(-6.850)	(-3.126)	(-5.508)	(-4.352)	(-3.470)	(-6.331)
R12lag	-0.0105*	0.00377	0.00294	-0.00955*	0.00531	-0.0126**
	(-1.821)	(1.024)	(0.686)	(-1.773)	(1.401)	(-2.190)
Constant	0.179***	0.165***	0.144***	0.198***	0.0892**	0.255***
	(4.640)	(3.369)	(3.660)	(4.265)	(2.388)	(5.429)
Obs	118,581	114,114	115,460	117,235	132,536	100,159
R-squared	0.079	0.086	0.084	0.081	0.076	0.089
Groups	71	64	63	72	67	68

Note: The t values calculated using the common standard error are in brackets, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively.

Some literature points out that there is a "January effect" in the illiquidity premium (Eleswarapu and Reinganum, 1993[28]; Hasbrouck, 2009[29]). In order to test whether the "Amihud premium" in the A-share market is related to the month. This paper divides 12 subsamples according to all the months of the sample, and then performs Fama-MacBeth regression respectively to compare the difference of "Amihud premium" in each month. The results are shown in Table 6. Except for February, the coefficients of Amihud_daily in the regression results for other months are all positive. The three months with the largest coefficients are August, April and June, and the coefficients are all over 0.01, while the three months with the smallest

coefficients are February, September, and October, and the coefficients of other months are between 0.006 and 0.01, close to the average. Therefore, the "Amihud premium" in the A-share market does not show a "January effect," and the "Amihud premium" in most months is significantly positive, indicating that the month is not the main factor affecting the "Amihud premium."

Based on the above analysis results, this paper confirms that the Amihud indicator has a robust positive correlation with expected stock returns in various sub-sectors, different market environments and most months. In the next part, this paper explores the formation mechanism of the "Amihud premium" in the A-share market from another perspective.

Table 6: Fama-MacBeth regression results by month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Amihud_daily	0.00652	-0.00384	0.00994**	0.0105	0.00646	0.0102	0.000769	0.0152**	0.00436	0.00525	0.00822**	0.00640
	(1.441)	(-0.925)	(2.450)	(1.739)	(1.518)	(1.530)	(0.176)	(2.565)	(1.122)	(0.897)	(2.691)	(1.350)
Me	0.00665	-0.0171**	-0.00848	0.00754	-0.00637	0.00982	-0.00264	0.00355	0.000454	0.00288	-0.00716	0.00371
	(1.072)	(-2.752)	(-1.448)	(1.218)	(-0.770)	(0.834)	(-0.314)	(0.466)	(0.0907)	(0.416)	(-1.145)	(0.407)
Bm	0.00610	0.00576	-0.00222	0.0109	-0.00666	-0.00151	0.00572	0.000689	0.000474	0.000790	0.00626	0.00423
	(1.558)	(1.559)	(-0.515)	(1.794)	(-1.228)	(-0.295)	(1.016)	(0.174)	(0.119)	(0.178)	(1.449)	(0.547)
R1lag	-0.0969**	-0.0495	-0.0694	-0.0444	-0.0293	-0.0438	-0.114*	-0.0694**	-0.0566	-0.0650***	-0.0822**	-0.0897**
	(-2.620)	(-1.653)	(-1.760)	(-1.319)	(-1.102)	(-1.104)	(-2.141)	(-2.319)	(-1.710)	(-3.435)	(-2.846)	(-2.588)
R12lag	-0.0129	-0.0126	-0.0176	0.00304	0.00460	0.0151	-0.00359	-0.00942	-0.0114	0.00651	-0.00486	0.00141
	(-0.751)	(-0.767)	(-0.825)	(0.375)	(0.487)	(1.321)	(-0.348)	(-1.086)	(-1.443)	(1.413)	(-0.447)	(0.199)
Constant	0.0488	0.231***	0.376***	0.151	0.264	0.0289	0.0928	0.267***	0.0922	0.0786	0.317**	0.112
	(0.562)	(4.947)	(4.667)	(1.557)	(1.726)	(0.350)	(1.066)	(3.235)	(0.899)	(0.671)	(2.823)	(0.639)
Obs	20,590	20,706	20,852	18,570	18,583	18,700	18,823	18,891	19,067	19,168	19,346	19,399
R-squared	0.112	0.072	0.092	0.047	0.067	0.080	0.107	0.087	0.059	0.059	0.105	0.100
Groups	12	12	12	11	11	11	11	11	11	11	11	11

Note: The t values calculated using the common standard error are in brackets, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively.

3.2.3 Is only the volume component of Amihud measure priced?

In this section, this paper first examines the effectiveness of the Amihud indicator in measuring stock illiquidity in the A-share market, and then answers the focus of debate between Lou and Shu (2017) [1] and Amihud and Noh (2018) [2]: Amihud Is the impact of the indicator on the expected stock return driven by the transaction value component? The purpose of this paper is to investigate whether the "Amihud premium" is caused by "illiquidity compensation" or "mispricing," and the phenomenon of premiums related to transaction volume is generally considered to be related to "mispricing" (Chordia et al, 2001 [36]; Zhang Zheng and Liu Li, 2006[9]; Barinov, 2014[10], etc.), so it is closely related to the research goal of this paper to explore whether the Amihud indicator is only priced in the transaction volume component.

First, this paper examines the effect of the Amihud indicator in measuring stock illiquidity in the A-share market, adding the Amihud indicator and high-frequency liquidity indicators (relative spread and quote depth, etc.) to the Fama-MacBeth regression model to conduct a "horse race" (horserace), to examine whether the Amihud indicator can capture the impact of high-frequency liquidity indicators on stock cross-sectional expected returns. The regression results are summarized in Table 7.

When relative spread (Rpd) is added to the model alone, the coefficient for Rpd is significantly positive at the 5% level. The larger the relative spread, the poorer the stock liquidity and the higher the expected return. This is consistent with the findings of Amihud and Mendelson (1986) [30] and the illiquidity premium theory of Acharya and Pedersen (2005) [62]. consistent. When Amihud is added to the model at the same time as relative spread, the coefficient of Rpd becomes insignificant. This shows that the part of the relative spread that can explain the expected return of the stock is absorbed by the Amihud indicator.

Meanwhile, Amihud's coefficient remains significant at the 1% level in a "horse race" against relative spreads. Relative spread is considered to be the best high-frequency liquidity indicator and is usually used as a benchmark for low-frequency liquidity indicators (Goyenko et al, 2009 [11]; Zhang Zheng et al., 2014 [12]), while relative spread has an impact on expected returns. The impact can be completely explained by the Amihud indicator, which shows that the Amihud indicator has a very good effect on characterization of stock illiquidity.

In addition, in the regression models (3) and (4), the estimated value of the regression coefficient of the first-level quotation depth Depth1 is significantly negative at the level of 5%,

which indicates that the greater the quotation depth, the lower the expected return. In the "horse race" between quote depth and Amihud indicator, the coefficient of quote depth becomes insignificant, which shows that Amihud can effectively capture the priced part of quote depth. Similar to the results of the one-stop quote depth, the effect of the five-notch quote depth on the expected return can also be fully explained by the Amihud indicator. This further proves that Amihud can effectively measure stock illiquidity, which is consistent with the conclusions of Goyenko et al (2009) [11], Zhang et al (2013) [12] and Lou and Shu (2017) [1] and other literatures.

Table 7: Amihud Metrics vs. High-Frequency Liquidity Metrics "Horse Race" Results

	Rpd	Rpd_Only	Depth1	Depth1_Only	Depth2	Depth2_Only
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)
Me	-0.000730	-0.00404**	-5.63e-05	-0.00276	-5.26e-05	-0.00281
	(-0.386)	(-2.171)	(-0.0293)	(-1.467)	(-0.0282)	(-1.503)
Bm	0.00189*	0.00139	0.00241**	0.00292***	0.00253**	0.00323***
	(1.714)	(1.197)	(2.228)	(2.615)	(2.568)	(3.124)
R1lag	-0.0681***	-0.0669***	-0.0687***	-0.0678***	-0.0691***	-0.0680***
	(-6.588)	(-6.471)	(-6.627)	(-6.597)	(-6.758)	(-6.716)
R12lag	-0.00364	-0.00504	-0.00397	-0.00521	-0.00407	-0.00538
	(-0.632)	(-0.889)	(-0.673)	(-0.909)	(-0.692)	(-0.946)
Amihud_daily	0.00583***		0.00614***		0.00604***	
	(4.614)		(4.433)		(4.099)	
Rpd	0.00277	0.00788**				
	(0.761)	(2.476)				
Depth1			-0.00176	-0.00503**		
			(-0.723)	(-2.334)		
Depth2					-0.00173	-0.00462**
					(-0.725)	(-2.276)
Obs	229,922	229,922	229,922	229,922	229,922	229,922
R-squared	0.091	0.086	0.091	0.082	0.093	0.083
Groups	133	133	133	133	133	133

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. To save space, constant terms are not reported here.

In order to study whether the Amihud indicator is priced related to the transaction volume, this paper combines the Amihud indicator with the IVOL indicator proposed by Lou and Shu (2017) [1] (replace the numerator of the Amihud indicator with 1), monthly transaction volume and Monthly turnover had a "horse race." In the regression, the above indicators are logarithmic. In addition, according to the method of Amihud and Noh (2018) [2], the Amihud indicator is

decomposed into parts related to volatility, trading volume, and the covariance between volatility and trading volume.

The empirical results are reported in Table 8. In the case of controlling for other variables, when the transaction value is added to the regression model alone, the coefficient of transaction value is significantly negative at the 1% level, indicating that the future returns of stocks with high transaction value will be relatively low. When Amihud and transaction value are added to the model at the same time, the coefficient of Amihud is no longer significant, while the coefficient of transaction value is still significantly negative at the level of 1%, and the coefficient is only slightly lower than when it was added alone, which shows that the Amihud indicator has The effect of expected returns can be explained entirely by transaction volume. The "horse race" of the Amihud metric and turnover rate showed similar results.

In addition, this paper also adds the IVOL indicator and the Amihud indicator used by Lou and Shu (2017) [1] into the model at the same time to see if the transaction volume component in the Amihud indicator can replace the Amihud indicator. The results show that the coefficient of IVOL is significant at the 10% level, while the coefficient of Amihud is not significant, which further shows that the Amihud indicator is only priced with components related to transaction volume.

In addition, Amihud and Noh (2018) [2] argue that the Amihud indicator should be decomposed by the following formula:

$$\ln(\overline{Amihud_{d,s}}) = \ln(\overline{|r_{d,s}|}) + \ln(\overline{1/dvol_{d,s}}) + DIF_s,$$

The subscript s represents the s-th month, the subscript d represents the d-th trading day in the s-th month, and $\ln(\overline{|r_{d,s}|})$ is the absolute value of the daily rate of return in the s-th month The logarithm of the mean, later denoted by ABS_R, which characterizes the volatility-related components, $\ln(\overline{1/dvol_{d,s}})$ is the same as lnIVOL used in and Lou and Shu (2017) [1], which is the logarithm of the mean of the reciprocal daily transaction volume, representing the part related to the transaction volume in the Amihud indicator, DIF_s is $\ln(\overline{Amihud_{d,s}})$ minus $\ln(\overline{|r_{d,s}|})$ and $\ln(\overline{1/dvol_{d,s}})$. A component related to the covariance of volatility and turnover. Amihud and Noh (2018) [2] argue that if IVOL is added alone in the model while ignoring the other two, it will cause endogeneity problems and bias the coefficient estimates of IVOL.

Table 8: "Horse race" results for Amihud metrics and its sub-components and transaction volume

	Trd	Trd_Only	Turnover	Turnover_Only	IVOL	IVOL_Trd	Deco	Deco_Trd
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Me	-0.00102	-0.00117	-0.00708***	-0.00782***	-0.000913	-0.00130	-0.00110	-0.000716
	(-0.521)	(-0.598)	(-2.806)	(-4.212)	(-0.483)	(-0.551)	(-0.506)	(-0.332)
Bm	0.00216*	0.00217	0.00216*	0.00217	0.00228*	0.00225	0.00222	0.00232*
	(1.666)	(1.637)	(1.666)	(1.637)	(1.771)	(1.588)	(1.632)	(1.713)
R1lag	-0.0674***	-0.0676***	-0.0674***	-0.0676***	-0.0658***	-0.0679***	-0.0661***	-0.0673***
	(-6.584)	(-6.582)	(-6.584)	(-6.582)	(-6.412)	(-6.926)	(-6.797)	(-6.898)
R12lag	-0.00244	-0.00253	-0.00244	-0.00253	-0.00259	-0.00244	-0.00270	-0.00238
	(-0.420)	(-0.439)	(-0.420)	(-0.439)	(-0.457)	(-0.697)	(-0.787)	(-0.698)
Amihud_daily	0.000708		0.000708		0.00208			
	(0.441)		(0.441)		(0.887)			
Trd	-0.00606***	-0.00666***				-0.00919***		-0.0106***
	(-3.332)	(-6.064)				(-4.622)		(-5.384)
Turnover			-0.00606***	-0.00666***				
			(-3.332)	(-6.064)				
IVOL (Trading volume Component）					0.00461*	-0.00271	0.00653***	-0.00345
					(1.804)	(-1.215)	(4.403)	(-1.519)
ABS_R (Volatility Component)							0.00103	0.00256
							(0.307)	(0.753)
DIF (Other Component)							0.00518	-8.04e-05
							(1.273)	(-0.0200)
Obs	232,695	232,695	232,695	232,695	232,695	232,695	232,695	232,695
R-squared	0.091	0.087	0.091	0.087	0.093	0.090	0.095	0.097
Groups	135	135	135	135	135	135	135	135

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. To save space, constant terms are not reported here.

Therefore, according to the formula provided by Amihud and Noh (2018) [2], this paper decomposes the Amihud indicator into the above three items, and then adds them to the model at the same time for Fama-MacBeth regression. The results are shown in model (7) in Table 9, the coefficient of IVOL is positive and significant at the 1% level, the coefficient of DIF is positive, but the coefficient of DIF and ABS_R are not significant. In addition, this paper also adds the transaction volume and the three components of the Amihud indicator to the model to conduct a "horse race." The results show that after controlling for the transaction amount, the coefficients of the three components of Amihud are not significant. This result reinforces the conclusion of this paper once again: the Amihud indicator is priced only for the components related to the transaction value.

Amihud and Noh (2018) [2] believe that the Amihud indicator estimates the expected value E(|R|/Vol) of the ratio of the absolute value of the daily rate of return |R| to the transaction volume Vol. In order to better estimate E(|R|/Vol), this paper increases the calculation frequency of the Amihud indicator. For example, first calculate the ratio of the absolute value of the rate of return per minute to the turnover, then take the daily average, and then calculate the monthly Taking the average, the sample size used to estimate E(|R|/Vol) will be greatly increased, which may help to improve the estimation accuracy. Therefore, this paper adopts the frequency of 3s, 1 minute, 5 minutes, 10 minutes, 15 minutes, 30 minutes and 60 minutes to calculate the Amihud indicator of each stock on each trading day, and then takes the average monthly, which are recorded as Amihud3s, Amihud01m, Amihud05m, Amihud10m, Amihud15m, Amihud30m and Amihud60m. In this paper, these high-frequency versions of the Amihud indicators and the transaction volume are respectively "horse races" to examine whether the Amihud indicators are still only priced in the components related to the transaction volume after increasing the calculation frequency. Table 9a and Table 9b show the results of the high-frequency version of the Amihud indicator and the transaction volume "horse race."

When the high-frequency Amihud indicators are added to the regression model alone, their coefficients are all significantly positive at the 1% level, which proves the robustness of the "Amihud premium" in the A-share market from another perspective. However, when Amihud indicator and transaction amount are added to the model at the same time, the coefficients of each Amihud indicator become insignificant, and even the sign becomes negative, indicating that transaction amount captures the positive impact of Amihud indicator on expected returns. This

result once again strongly proves that the Amihud indicator is priced with only a transaction value-related component.

Table 9a: "Horse race" results of the high-frequency version of the Amihud indicator and transaction volume

	Amihud3s	Amihud3s_Only	Amihud01m	Amihud01m_Only	Amihud05m	Amihud05m_Only	Amihud10m	Amihud10m_Only
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Me	-0.000642	-0.00339*	-0.000425	-0.00140	-0.000686	-0.000997	-0.000667	-0.000726
	(-0.320)	(-1.724)	(-0.212)	(-0.721)	(-0.340)	(-0.518)	(-0.332)	(-0.373)
Bm	0.00174	0.00127	0.00183	0.00150	0.00193	0.00215*	0.00190	0.00228*
	(1.564)	(1.106)	(1.535)	(1.254)	(1.534)	(1.745)	(1.511)	(1.847)
R1lag	-0.0681***	-0.0670***	-0.0668***	-0.0669***	-0.0663***	-0.0664***	-0.0665***	-0.0664***
	(-6.623)	(-6.478)	(-6.329)	(-6.344)	(-6.333)	(-6.334)	(-6.355)	(-6.350)
R12lag	-0.00259	-0.00449	-0.00271	-0.00405	-0.00267	-0.00401	-0.00263	-0.00405
	(-0.452)	(-0.783)	(-0.465)	(-0.686)	(-0.453)	(-0.688)	(-0.448)	(-0.696)
Trd	-0.00666***		-0.00591***		-0.00738***		-0.00764***	
	(-4.837)		(-3.268)		(-3.243)		(-3.176)	
Amihud3s	0.000774	0.00439***						
	(0.459)	(2.952)						
Amihud01m			0.00134	0.00601***				
			(0.818)	(5.506)				
Amihud05m					-0.000231	0.00576***		
					(-0.113)	(5.119)		
Amihud10m							-0.000456	0.00617***
							(-0.212)	(5.479)
Obs	229,922	229,922	230,582	230,582	230,581	230,581	230,576	230,576
R-squared	0.095	0.084	0.092	0.084	0.091	0.086	0.091	0.086
Groups	133	133	133	133	133	133	133	133

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. To save space, constant terms are not reported here.

Table 9b: "Horse race" results of the high-frequency version of the Amihud indicator and transaction volume

	Amihud15m	Amihud15m Only	Amihud30m	Amihud30m Only	Amihud60m	Amihud60m Only
Dep: R-rf	(9)	(10)	(11)	(12)	(13)	(14)
Me	-0.000740	-0.000638	-0.000730	-0.000433	-0.000627	-0.000393
	(-0.372)	(-0.327)	(-0.366)	(-0.216)	(-0.315)	(-0.197)
Bm	0.00189	0.00232*	0.00189	0.00233*	0.00192	0.00230*
	(1.503)	(1.864)	(1.500)	(1.862)	(1.534)	(1.828)
R1lag	-0.0664***	-0.0664***	-0.0665***	-0.0664***	-0.0666***	-0.0666***
	(-6.349)	(-6.342)	(-6.350)	(-6.328)	(-6.357)	(-6.312)
R12lag	-0.00256	-0.00406	-0.00263	-0.00407	-0.00268	-0.00403
	(-0.439)	(-0.696)	(-0.452)	(-0.696)	(-0.462)	(-0.687)
Trd	-0.00735***		-0.00760***		-0.00732***	
	(-3.563)		(-3.505)		(-3.402)	
Amihud15m	-0.000281	0.00633***				
	(-0.149)	(5.662)				
Amihud30m			-0.000521	0.00664***		
			(-0.259)	(5.817)		
Amihud60m					-0.000135	0.00668***
					(-0.0685)	(5.940)
Obs	230,575	230,575	230,572	230,572	230,570	230,570
R-squared	0.091	0.085	0.091	0.085	0.091	0.085
Groups	133	133	133	133	133	133

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. To save space, constant terms are not reported here.

3.2.4 Cumulative returns of holding the high-Amihud-portfolio and low-Amihud-portfolio in last month

Through a series of Fama-MacBeth regression analysis, this paper confirms the positive relationship between the Amihud indicator and the expected stock return, and this relationship is driven by the trading volume-related component of the Amihud indicator. However, regression analysis doesn't tell the whole story. The coefficient of the Amihud indicator is positive, which can only mean that the yield of the high-Amihud portfolio is higher than that of the low-Amihud portfolio. As for the specific reason for this yield gap, the high-Amihud portfolio has a larger increase, or the low-Amihud portfolio has low returns, or two Both are still unknown. Therefore, in order to clarify the formation mechanism of "Amihud premium," this paper examines the returns of various stock portfolios with different Amihud levels.

The method of constructing the investment portfolio in this paper is as follows: at the beginning of the sth month, the stocks are divided into ten groups on average from low to high according to the Amihud index of the s-1st month, and then the stocks in these ten groups are invested in equal weights respectively, and s is the sample of this paper. The number of each month in the period, and the portfolio is updated at the beginning of each month. As in Fama and French (1992 [56], 2015 [13], 2016 [14]), this paper does not consider various market frictions that may affect investment returns, such as transaction fees and taxes.

Figure 2 shows the cumulative returns from January 2007 to March 2018, investing in Amihud's lowest (Group 1), mid-range (5), and highest (10) portfolios of stocks at the beginning of each month.

Overall, the investment returns of the three portfolios show a very clear differentiation phenomenon. Although the yields of the three showed a certain synchronization, for example, they rose simultaneously in the bull market in 2007 and fell simultaneously during the financial crisis in 2008. They also had a relatively synchronized increase in the rapid rise of the A-share market in 2015 and the subsequent stock market crash. performance, but the gap in the cumulative returns of the three portfolios continued to widen throughout the analysis period. Among them, the lowest Amihud portfolio has the lowest return, and has been sluggish throughout the period, recording consistent negative returns. The highest Amihud portfolios, on the other hand, show a strong upward trend, with cumulative returns near the highest point at the end of the sample period. The cumulative return trend of the portfolio with medium Amihud level is relatively stable, falling

between the first two. The yield performance of these three portfolios shows from another perspective that the "Amihud premium" in the A-share market is very significant and stable.

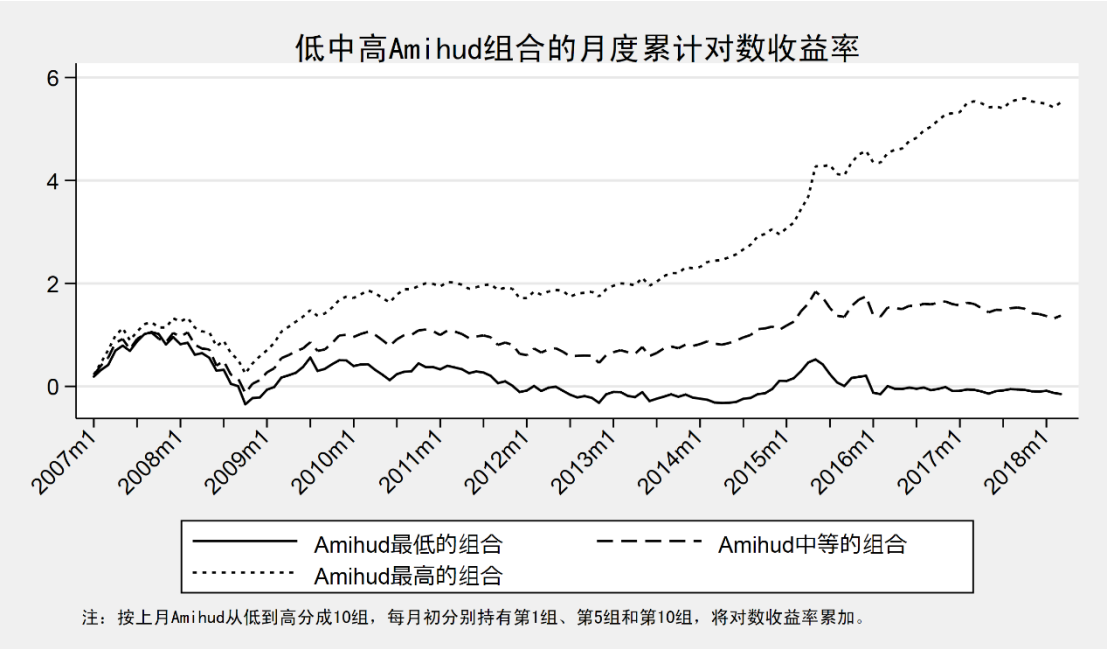

Figure 2: Cumulative returns at the beginning of each month for holding the lowest, medium and highest portfolios of Amihud in the previous month

In addition, in order to eliminate the heterogeneity of individual stock returns and the differences in stock returns caused by exposure to common risk factors in the literature, this paper subtracts the returns of all stocks by the Fama-MacBeth five-factor (hereinafter referred to as FF5 factor) model. expected part. The specific method is to perform a time-series regression on the excess returns of all individual stocks (considering the return on dividend reinvestment minus the monthly one-year deposit interest rate) on the FF5 factor, and then subtract the estimated value of the intercept term (depicting the return of individual stocks). The heterogeneity of the rate does not change with time), and then subtract the product of each factor coefficient and the realized value of the current risk factor (to measure the part of the stock return explained by each risk factor), and finally get the individual stock return adjusted by the FF5 factor.

Figure 3 presents the cumulative FF5-factor-adjusted yield curves for three portfolios with the lowest, medium, and highest Amihud levels held by investors from January 2007 to the beginning of each month in March 2018, respectively. In general, the differentiation of the cumulative returns

of the three portfolios is more obvious. The yield curve for the top Amihud portfolios is almost straight up, dipping slightly in some periods, but hitting new highs overall. After adjustment by the FF5 factor, the cumulative return of the high Amihud portfolio has decreased a lot (the logarithmic return has dropped from close to 6 to about 1.7, and the corresponding percentage return has dropped from about 300 times to 50 times), but the range of returns is still very high. considerable. In addition, the portfolio with medium Amihud level is relatively flat, and the cumulative return fluctuates around 0. The yield curve for the portfolio with the lowest Amihud is straight down. Throughout the sample period, the yield gap between high-Amihud portfolios and low-Amihud portfolios continued to widen, which confirms the previous conclusion: the dominant factor in the "Amihud premium" in the A-share market is not the overall market environment, such as investor sentiment, liquidity or Uncertainty, etc., does not only occur in one month, but it also exists steadily in all periods.

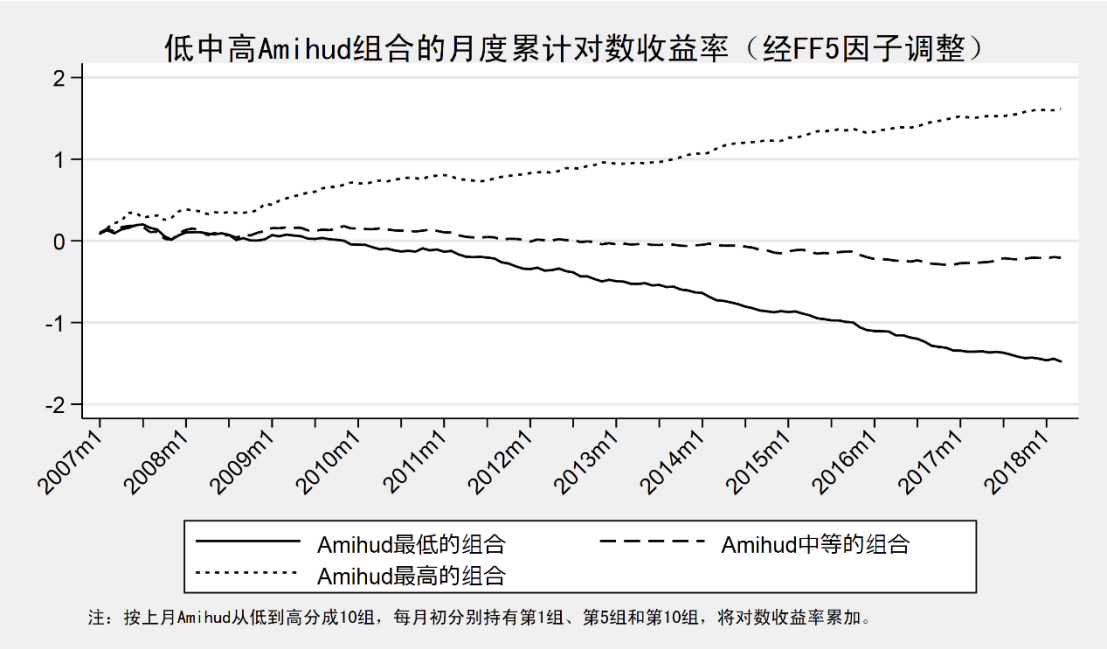

Figure 3: Cumulative yield of holding the Amihud low, medium and high portfolio of the previous month at the beginning of each month (adjusted by FF5)

In addition, since the previous analysis shows that the "Amihud premium" is driven by the trading volume component, this paper also analyzes the cumulative returns of holding the stock portfolio with the lowest, medium, and highest trading volume of the previous month at the

beginning of each month, and considers the FF5 Factor-adjusted cumulative return. The results are shown in Figure 4 and Figure 5, respectively.

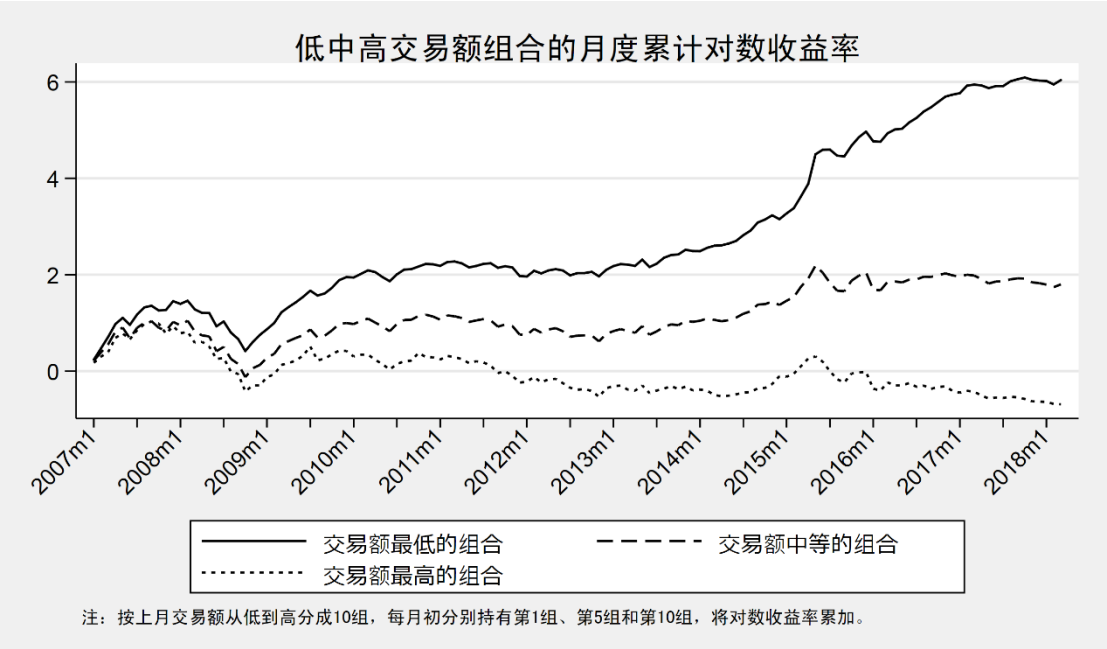

Figure 4: Cumulative returns at the beginning of each month for holding the lowest, medium and highest portfolios in the previous month

The differentiation of the cumulative returns of the three portfolios with different trading volume levels is also very obvious. In addition, the cumulative return of portfolios sorted by transaction value is very similar to that of Amihud, where the portfolio with the lowest transaction value corresponds to the portfolio with the highest Amihud, and the portfolio with the highest transaction value corresponds to the portfolio with the lowest Amihud. The trend and the final cumulative return are very close, which shows from another perspective that the "Amihud premium" is dominated by the components related to the transaction volume in the indicator.

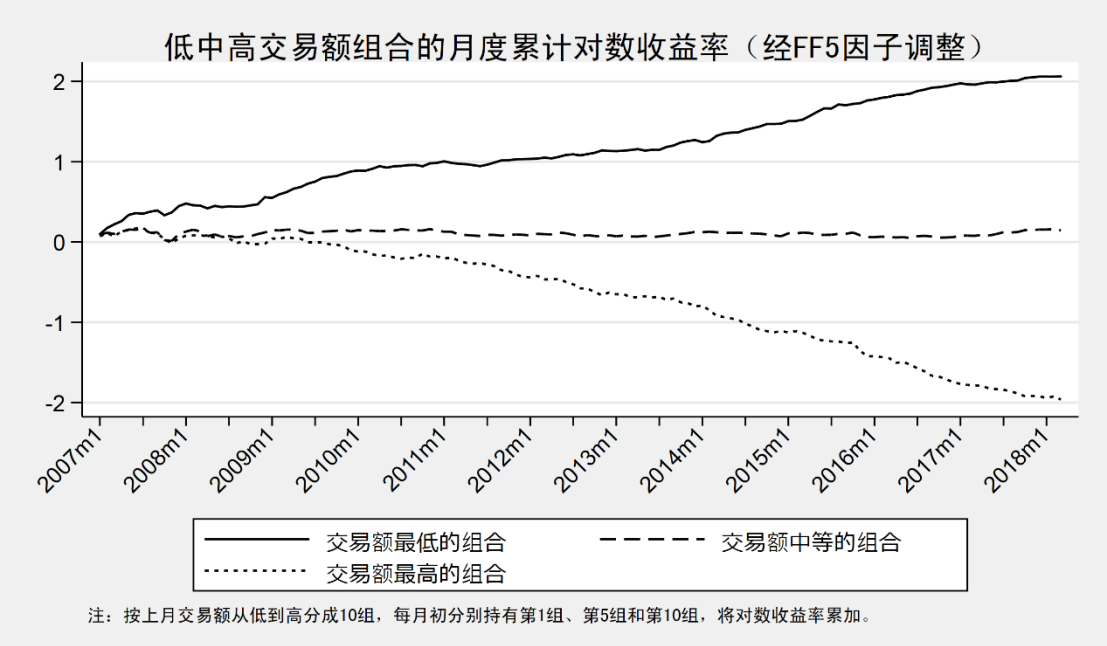

Figure 5: At the beginning of each month, the cumulative yield of holding a portfolio with low, medium and high transaction volume in the previous month (adjusted by FF5)

3.2.5 Regression analyses employing Fama-French five-factor model

In the analysis of the cumulative returns of the portfolios with the highest, middle, and lowest Amihud levels in the previous section, the high Amihud portfolio showed high returns, while the low Amihud portfolios had low, or even negative, returns. In this chapter, this paper uses the five-factor model of Fama and French (2015) [13] to perform regression analysis on the average return of the portfolio with different Amihud levels and the return difference between the portfolios and test them in controlling five classic risk factors. Whether it is still economically and statistically significant afterwards.

Table 10 shows the five-factor model regression results of the returns of 10 stock portfolios with different Amihud levels and the difference between the returns of the high Amihud portfolio and the low Amihud portfolio (Top Minus Bottom, TMB). Considering that the variance of portfolio returns in different periods may be different, this paper uses the robust standard error of White (1980) [63] to calculate the t-statistic. The coefficients of the ten portfolios to the market risk premium are all significant. The exposure of the high Amihud portfolio to market risk is significantly lower than that of the low Amihud portfolio at the level of 5%, while the coefficient of SMB increases with the increase of the Amihud level. The high Amihud portfolio increases. The

coefficient of SMB is significantly higher than that of the low-Amihud portfolio at the 1% level, indicating that the stock returns of the high-Amihud portfolio behave more like the small-cap portfolio. There is no significant difference in the coefficients of HML, RMW and CMA between the high Amihud portfolio and the low Amihud portfolio, which shows that after controlling for the market risk premium and market capitalization factors, the return difference between the high Amihud portfolio and the low Amihud portfolio is not determined by the portfolio. It is dominated by differences in stock valuation levels, profitability and investment styles within the country.

This paper focuses on the magnitude of the coefficient of the intercept term (Alpha) and its significance. The Alpha of the TMB portfolio is positive and significant at the 1% level, with a size of 2.82% and an annualized excess return of 33.84% (2.82%*12). Among the Amihud combinations in each subdivision, the Alpha of the low Amihud combination is -0.5%, which is significant at the 5% level, while the Alpha of the high Amihud combination reaches 2.3%, and the Alpha of the other combinations in between varies with the Amihud level. increases and increases. This result shows that the "Amihud premium" still exists after excluding the influence of various risk factors, and it is both economically and statistically significant.

In estimating the coefficients of the five-factor model, this paper uses data from the entire sample period, which may be subject to "hindsight." Because investors can only use past information to estimate the risk factor coefficient of the investment portfolio in various periods in history, which may be different from the factor coefficient estimate obtained by using the entire sample, so the Alpha estimate may also be biased. Therefore, this paper also adopts the method of rolling sample regression, using the factor coefficients estimated by the samples of the past 60 months to calculate the current Alpha, and then test whether the mean of Alpha is significant.

The results are shown in the last row of Table 10. After excluding the influence of "hindsight," the Alpha of the TMB combination became larger, reaching 3.93%, of which the Alpha of the low Amihud group was -0.7%, and the Alpha of the high Amihud combination was -0.7%. is 3.2%, and Alpha increases as the level of the combined Amihud increases. The results of this analysis consolidate the conclusions of this paper.

In addition, this paper also uses the Fama-French three-factor model [56] and the Carhart four-factor model [64] to perform regression analysis on the return of the investment portfolio, and the results are consistent with the analysis of the five-factor model.

Table 10: Five-factor model regression results for portfolios with different Amihud levels

	Bottom	2	3	4	5	6	7	8	9	Top	TMB
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
RiskPremium1	1.123***	1.069***	1.048***	1.000***	0.999***	1.009***	1.004***	0.992***	0.986***	0.967***	-0.156**
	(0.0300)	(0.0363)	(0.0335)	(0.0310)	(0.0282)	(0.0291)	(0.0229)	(0.0219)	(0.0222)	(0.0569)	(0.0630)
SMB1	0.00248	0.429***	0.688***	0.833***	0.993***	1.032***	1.141***	1.161***	1.259***	1.400***	1.398***
	(0.0733)	(0.109)	(0.0979)	(0.0916)	(0.0825)	(0.0930)	(0.0662)	(0.0737)	(0.0743)	(0.284)	(0.308)
HML1	-0.108	-0.0855	-0.0686	-0.0638	0.00452	0.0185	0.00363	-0.00915	-0.0744	-0.125	-0.0164
	(0.0715)	(0.0953)	(0.0865)	(0.0804)	(0.0760)	(0.0803)	(0.0600)	(0.0702)	(0.0781)	(0.235)	(0.261)
RMW1	-0.177	-0.263	-0.208	-0.100	-0.0209	-0.0628	0.0211	0.0467	0.101	0.156	0.334
	(0.160)	(0.213)	(0.181)	(0.177)	(0.155)	(0.172)	(0.129)	(0.142)	(0.143)	(0.257)	(0.290)
CMA1	0.226	0.230	0.243	0.207	0.246*	0.192	0.206*	0.264**	0.194	0.389*	0.163
	(0.163)	(0.187)	(0.166)	(0.159)	(0.146)	(0.149)	(0.122)	(0.123)	(0.122)	(0.217)	(0.289)
Constant	-0.00525**	-0.00816***	-0.00655***	-0.00678***	-0.00499**	-0.00280	0.00113	0.00100	0.00508***	0.0230***	0.0282***
	(0.00207)	(0.00237)	(0.00215)	(0.00201)	(0.00201)	(0.00193)	(0.00157)	(0.00163)	(0.00175)	(0.00377)	(0.00428)
Obs	135	135	135	135	135	135	135	135	135	135	135
R-squared	0.952	0.938	0.951	0.954	0.960	0.963	0.972	0.973	0.972	0.833	0.561
Alpha_Nohindsight	-0.00707***	-0.0108***	-0.00830***	-0.00786***	-0.00451**	-0.00299*	0.00163	0.000564	0.00699***	0.0322***	0.0393***
	(0.00177)	(0.00201)	(0.00204)	(0.00216)	(0.00181)	(0.00161)	(0.00121)	(0.00151)	(0.00167)	(0.0108)	(0.0117)

Note: In parentheses are t values calculated using White (1980) robust standard error of heteroskedasticity, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. The dependent variable of the regression is the monthly excess return of each portfolio. Bottom, 2, ..., Top are ten combinations of Amihud indicators from low to high. TMB is short for Top Minus Bottom, which represents the difference between the returns of the portfolio with the highest Amihud indicator and the portfolio with the lowest Amihud. Alpha_Nohindsight is the alpha value estimated for the rolling sample using the past 60 months.

3.2.6 The Characteristics of high-Amihud-portfolio and low-Amihud-portfolio

What factors account for the huge difference in returns between high and low Amihud portfolios? To explore this issue, this paper analyzes the differences in the indicators of various dimensions between high Amihud combinations and low Amihud combinations. In order to reduce the influence of potential extreme values, this paper winsorize the 1% and 99% quantiles of continuous variables. Since the difference in various indicators between the high Amihud combination and the low Amihud combination is a monthly time series, there may be autocorrelation, so this paper uses the Newey-West robust standard error with a lag order of 6 in the statistical test.

Similarly, this paper is divided into 10 groups from low to high Amihud levels from month s-1, where 1 represents the combination with the lowest Amihud level, 10 represents the combination with the highest Amihud level, and so on, s is the number of all months in the sample period of this paper. This paper first averages all stocks in the portfolio in each month, and then averages all months. After averaging all the months (corresponding to different s), the signs of the months change from s-1st and sth to -1st and 0th respectively.

Table 11 reports the average return level of the ten portfolios in month 0 and the standard deviation of the stock returns in the portfolio, as well as the standard deviation of the average return of the portfolio in the time series. The calculation method of the first standard deviation is: first take the standard deviation of the returns of each stock in the portfolio in each month, and then take the average by month. It measures the difference in the returns of individual stocks within a portfolio. The second standard deviation is to first average the percentage returns of the stocks in the portfolio in each month s to obtain the average return of the s month, convert it into a logarithmic return, and then take the standard of the return time series. Difference. It describes the volatility of the average return of the entire portfolio. Consistent with the previous results, the average return of the portfolio with the lowest Amihud level in month -1 was -0.12% in month 0, while the return of the portfolio with the highest Amihud level was 2.92%, and the difference between the two returns reached 3.17%. significant at the % level. After adjusting the returns of individual stocks using the FF5 factor model, the average returns of the low-Amihud portfolio and the high-Amihud portfolio become -1.05% and 0.96%, respectively, and the t-statistic of the difference between the two reaches 8.6. At the same time, the standard deviation of returns within the portfolio of the high Amihud portfolio is also significantly higher than that of the low Amihud

portfolio. In addition, the standard deviation of the average return of the high Amihud portfolio is 11.0%, slightly higher than the 10.2% of the low Amihud portfolio. In addition, Amihud_daily is the variable used in this paper when sorting and grouping stocks in the -1 month, the gap between the high Amihud portfolio and the low Amihud portfolio is very obvious, and the t-statistic is as high as 45.5.

In addition, this paper also compares the average trading days, trading volume, turnover rate, relative spread, one-level quotation depth and five-level quotation depth of each combination in the -1st month. These indicators measure different dimensions of a stock's liquidity, respectively. The high-Amihud portfolio has an average of 1.75 fewer trading days per month than the low-Amihud portfolio, suggesting that stocks in the high-Amihud portfolio are more likely to experience a suspension. In terms of transaction volume, the average monthly transaction volume of the high Amihud portfolio is about 800 million yuan, which is much lower than the 9.6 billion yuan of the low Amihud portfolio. In terms of turnover rate, the average monthly turnover rate of high Amihud portfolios is 50.6%, which is nearly 10 percentage points lower than that of low Amihud portfolios. There is also a large gap between the high Amihud portfolio and the low Amihud portfolio in terms of relative spread. The average relative spread of the high Amihud portfolio is 0.21%, which is nearly twice that of the low Amihud portfolio. In addition, there is also a big difference between the two in terms of quotation depth. The average quotation depth of the high Amihud combination is 117,000 yuan and the fifth-level quotation depth are 654,000 yuan respectively, while the first and fifth-level quotation depth of the low Amihud combination is 117,000 yuan and 654,000 yuan respectively. Reached 636,000 yuan and 4.596 million yuan. These data show that the liquidity of high Amihud portfolios is relatively poor from different dimensions of liquidity.

This paper also examines the differences in the valuation level and performance growth of the high-Amihud portfolio and the low-Amihud portfolio in the -1st month. The analysis results are summarized in Table 12. From the perspective of profitability, revenue, operating cash flow, etc., the high Amihud portfolio clearly shows a lower level. In addition, the high Amihud portfolio is also significantly lower than the low Amihud portfolio in terms of earnings growth rate, revenue growth rate, operating cash flow growth rate, and company growth score. In general, stocks with high Amihud portfolios are not only more valuable than stocks with low Amihud portfolios, but also have poorer growth potential.

Table 11: Comparison of Returns, Standard Deviations, and Liquidity Indicators for Portfolios at Different Amihud Levels

Amihud-decile	Average_R	Average_R_ff5	Sd_R_Stocks	Sd_R_Time	Amihud_daily	Nday	Trd	Turnover	Rpd	Depth1	Depth2
Low	-0.0012	-0.0105	0.0996	0.102	-23.601	19.816	9,625,129,984	0.604	0.113	635,627	4,596,289
2	0.0011	-0.0094	0.1039	0.107	-22.725	19.788	4,454,452,224	0.706	0.126	323,580	2,230,224
3	0.0055	-0.0054	0.1033	0.109	-22.318	19.758	3,039,113,728	0.709	0.137	252,515	1,697,323
4	0.0063	-0.0050	0.1020	0.107	-22.026	19.805	2,299,630,848	0.688	0.146	214,603	1,415,647
5	0.0097	-0.0016	0.1023	0.109	-21.783	19.816	1,849,156,992	0.673	0.153	186,938	1,209,153
6	0.0123	0.0006	0.1013	0.111	-21.562	19.845	1,524,998,400	0.653	0.161	165,002	1,053,606
7	0.0169	0.0043	0.1012	0.111	-21.344	19.820	1,243,596,416	0.623	0.168	145,138	910,042
8	0.0170	0.0041	0.0988	0.111	-21.114	19.837	1,017,427,520	0.594	0.176	127,518	785,186
9	0.0215	0.0080	0.0993	0.111	-20.836	19.791	814,164,032	0.553	0.187	111,010	666,611
High	0.0292	0.0096	0.1171	0.110	-20.110	18.642	819,407,296	0.506	0.209	116,832	654,237
High-Low	0.0317***	0.0201***	0.0175***	0.007	3.491***	-1.175***	-8.806e+09***	-0.0976***	0.0957***	-518,834***	-3.942e+06***
T-Statistic	(6.109)	(8.648)	(3.433)		(45.52)	(-4.735)	(-11.05)	(-3.490)	(8.709)	(-19.26)	(-16.38)

Note: The brackets are the t-statistic calculated using the robust standard error of Newey-West (1987) with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. This article is divided into 10 groups according to the level of Amihud from low to high in the s-1st month. Low represents the combination with the lowest Amihud index, High represents the combination with the highest Amihud index, and 2 to 9 represent the other 8 groups from low to high according to the Amihud index. Portfolio divided equally; s is the number of all months in the sample period of this paper. Unless otherwise specified, the calculation method of each indicator is to take the average of all stocks in the portfolio in the s-1st month, and then take the average of all months. Average_R: The average return of the portfolio, first take the average of the percentage returns of all stocks in the portfolio in month s, convert it into logarithmic returns, and then take the average of all months; Average_R_ff5: Subtract the return of individual stocks by the part expected by the FF5 model After calculating the average return of the portfolio, the steps are the same as Average_R; Sd_R_Stocks: the standard deviation of the stock returns in the portfolio, take the standard deviation of the percentage returns of all stocks in the portfolio in month s, and then take the average of all months; Sd_R_Time: The standard deviation of the monthly portfolio logarithmic rate of return, take the mean of the percentage rate of return of all stocks in the portfolio in month s, convert the monthly portfolio rate of return into logarithmic rate of return, and then calculate the standard deviation of all monthly rates of return ;Amihud_daily: Amihud indicator calculated using daily data; Nday: Monthly trading days; Trd: Monthly trading volume (RMB); Turnover: Monthly turnover rate; Rpd: Relative spread; Depth1: First-level quotation depth (RMB); Depth2 : Five-level quotation depth (yuan). Data source: GTA CSMAR database.

Table 12: Comparison of valuation levels and growth of portfolios with different Amihud levels

Amihud-decile	Earning	Nav	Revenue	Oncf	Dividend	Ovs	Npgrowth	Egrowth	Rgrowth	Oncfgrowth	Ogs	Vcg
Low	0.047	0.412	0.636	0.062	0.014	0.171	0.318	0.320	0.351	0.335	0.441	0.267
2	0.033	0.379	0.590	0.037	0.012	0.148	0.034	0.273	0.321	0.163	0.318	0.168
3	0.029	0.377	0.561	0.034	0.011	0.143	0.015	0.260	0.323	0.113	0.297	0.151
4	0.026	0.383	0.557	0.032	0.011	0.142	-0.122	0.248	0.312	0.025	0.230	0.081
5	0.024	0.384	0.551	0.031	0.011	0.141	-0.269	0.241	0.301	0.011	0.188	0.040
6	0.022	0.383	0.547	0.031	0.011	0.139	-0.353	0.238	0.302	-0.044	0.147	0.000
7	0.021	0.377	0.540	0.030	0.011	0.137	-0.461	0.225	0.296	-0.046	0.098	-0.055
8	0.019	0.371	0.531	0.028	0.011	0.135	-0.537	0.217	0.295	-0.148	0.038	-0.112
9	0.016	0.358	0.511	0.024	0.012	0.129	-0.631	0.210	0.293	-0.187	0.009	-0.137
High	0.008	0.311	0.426	0.018	0.011	0.106	-1.038	0.193	0.276	-0.280	-0.147	-0.276
High-Low	-0.0394***	-0.101***	-0.210***	-0.0442***	-0.00351***	-0.0644***	-1.356***	-0.127***	-0.0745***	-0.615***	-0.588***	-0.543***
T-Statistic	(-20.09)	(-5.387)	(-7.430)	(-25.29)	(-4.663)	(-10.47)	(-10.15)	(-7.658)	(-7.062)	(-5.458)	(-11.62)	(-10.39)

Note: The brackets are the t-statistic calculated using the robust standard error of Newey-West (1987) with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. This article is divided into 10 groups according to the Amihud level from low to high in the s-1st month. Low represents the combination with the lowest Amihud indicator, High represents the combination with the highest Amihud indicator, and 2 to 9 represent the other 8 according to the Amihud indicator from low to high. Portfolios are divided equally. s is the number of all months in the sample period of this paper. Unless otherwise specified, the calculation method of each indicator is to take the average of all stocks in the portfolio in the s-1st month, and then take the average of all months. Earning: earnings per share/stock price; Nav: net assets per share/stock price; Revenue: main business income per share/stock price; Oncf: operating cash flow per share/stock price; Dividend: cash dividend per share/stock price; Ovs: Stock Value Score; NpGrowth: Net Profit Growth Rate; Egrowth: Net Asset Growth Rate; Rgrowth: Main Business Income Growth Rate; Oncfgrowth: Operating Cash Flow Growth Rate; Ogs: Stock Growth Score; Vcg: Stock Value Mixed Growth Score. Data source: GTA CSMAR database.

In addition, this paper compares the risk characteristics of each portfolio in terms of stock price volatility, correlation with market returns, systematic risk, unsystematic risk, and realized volatility in -1 month. The results are reported in Table 13. In terms of stock return volatility, the low Amihud portfolio is not significantly different from the high Amihud portfolio. However, the beta, correlation to market returns, unsystematic risk, and realized volatility across frequencies of the high Amihud portfolio are significantly lower than those of the low Amihud portfolio.

This paper also examines the differences between the high-Amihud portfolio and the low-Amihud portfolio in terms of asset size, auditor type, analyst and research attention, company information transparency, and shareholding concentration. Results are reported in Table 14. The difference in company size between the two is huge. The average total asset size of the high-Amihud portfolio is 2.3 billion, while the average company asset of the low-Amihud portfolio reaches 95.2 billion, a difference of nearly 50 times. The high Amihud portfolio also employs the Big Four or foreign accounting firms at a significantly lower rate than the low Amihud portfolio.

In terms of research reports and analysts' attention levels, high-Amihud portfolios have less than 3 analysts' attention on average, while stocks with low-Amihud portfolios are followed by more than 18 analysts on average. Stocks with high Amihud portfolios have an average of 5 relevant research reports, while stocks with low Amihud portfolios have an average of 38.

In terms of company information transparency, according to the "Transparency of Listed Companies" issued by the Shanghai Stock Exchange and Shenzhen Stock Exchange, the information transparency of the high Amihud portfolio is also significantly worse than that of the low Amihud portfolio.

In terms of shareholding concentration, the high Amihud portfolio is more dispersed. From the shareholding ratio of the first largest shareholder, the sum of the shareholding ratio of the second largest shareholder to the tenth largest shareholder, the ratio of the shareholding ratio of the first largest shareholder to the second largest shareholder, and the Herfindahl index of the top ten shareholders, etc. From the perspective of these indicators, the holding concentration of high-Amihud portfolios is significantly lower than that of low-Amihud portfolios.

Overall, compared with the low-Amihud portfolio, the high-Amihud portfolio has many attributes that are considered unfavorable to investors, such as higher transaction costs, poorer performance and growth, opaque information disclosure, smaller company size, analysts and Research reports are less concerned and shareholding concentration is low. However, from the

perspective of return and risk level, the high Amihud portfolio not only enjoys higher returns, but also only needs to take on a lower level of risk.

On the other hand, the low return and high risk of low Amihud portfolios coexist, which may mean "mispricing" of low Amihud portfolios. In addition, the low Amihud portfolio has a negative return on investment and is more pronounced after adjusting for the FF5 factor, a phenomenon that cannot be explained by “illiquidity compensation” because even the most liquid treasury bonds in the market reverse repurchase or Exchange money funds can also enjoy risk-free returns. Therefore, the formation mechanism of the negative return of the low Amihud portfolio needs further analysis and discussion.

Table 13: Comparison of risk characteristics of portfolios with different Amihud levels

Amihud-decile	Volatility	Beta	Cor	Nonsysrisk	Rsq	Arsq	Rv3s	Rv01m	Rv05m	Rv10m	Rv15m	Rv30m	Rv60m
Low	0.488	1.133	0.602	0.105	0.384	0.381	0.043	0.027	0.029	0.027	0.027	0.026	0.025
2	0.512	1.157	0.584	0.107	0.360	0.358	0.043	0.029	0.030	0.029	0.028	0.027	0.026
3	0.513	1.152	0.580	0.107	0.355	0.352	0.043	0.029	0.030	0.029	0.028	0.027	0.026
4	0.513	1.149	0.579	0.106	0.353	0.351	0.042	0.029	0.030	0.028	0.028	0.027	0.026
5	0.512	1.143	0.577	0.105	0.351	0.348	0.041	0.028	0.030	0.028	0.027	0.027	0.026
6	0.511	1.138	0.574	0.104	0.348	0.346	0.041	0.028	0.030	0.028	0.027	0.026	0.025
7	0.509	1.130	0.573	0.103	0.347	0.344	0.040	0.028	0.029	0.028	0.027	0.026	0.025
8	0.507	1.122	0.570	0.101	0.343	0.340	0.039	0.027	0.029	0.027	0.027	0.026	0.025
9	0.505	1.104	0.563	0.097	0.335	0.332	0.038	0.027	0.029	0.027	0.026	0.025	0.024
High	0.498	1.051	0.536	0.086	0.307	0.304	0.038	0.025	0.028	0.026	0.025	0.024	0.023
High-Low	0.00997	-0.0825***	-0.0664***	-0.0190***	-0.0766***	-0.0769***	-0.00411***	-0.00204***	-0.00111**	-0.000805*	-0.00114***	-0.00156***	-0.00161***
T-Statistic	(1.138)	(-2.615)	(-5.402)	(-3.095)	(-6.308)	(-6.308)	(-2.697)	(-3.044)	(-2.288)	(-1.865)	(-2.621)	(-3.318)	(-3.408)

Note: The brackets are the t-statistic calculated using the robust standard error of Newey-West (1987) with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. This article is divided into 10 groups according to the Amihud level from low to high in the s-1st month. Low represents the combination with the lowest Amihud indicator, High represents the combination with the highest Amihud indicator, and 2 to 9 represent the other 8 according to the Amihud indicator from low to high. Portfolios are divided equally. s is the number of all months in the sample period of this paper. Unless otherwise specified, the calculation method of each indicator is to take the average of all stocks in the portfolio in the s-1st month, and then take the average of all months. Volatility: return volatility; Beta: beta coefficient estimated by capital asset pricing model; Cor: correlation coefficient between individual stock excess return and market excess return; Nonsysrisk: non-systematic risk estimated by capital asset pricing model; Rsq: capital asset pricing model The R-squared of the model; ARsq: the adjusted R-squared of the capital asset pricing model; Rv3s, Rv01m, Rv05m..., Rv30m and Rv60m represent the usage frequency of 3 seconds, 1 minute, 5 minutes,..., 30 minutes, respectively and realized volatility calculated from 60 minutes of data. Data source: GTA CSMAR database.

Table 14: Comparison of Asset Size, Auditor Type, Attention, Company Information Transparency and Holding Concentration of Portfolios at Different Amihud Levels

Amihud-decile	Companysize	Big4	Outside	Anaattention	Reportattention	Companyopacity	Negshrcr1	Negshrs	Negshrz	Negshrh10
Low	95,182,831,616	0.290	0.181	18.224	38.024	1.729	22.034	13.722	11.662	0.095
2	15,819,598,848	0.096	0.043	11.074	21.981	1.918	19.646	11.675	10.179	0.078
3	8,932,434,944	0.061	0.027	8.973	17.513	1.972	17.997	11.194	9.228	0.069
4	6,672,684,032	0.048	0.020	7.637	14.765	2.000	17.212	10.979	8.978	0.066
5	5,438,190,592	0.042	0.018	6.701	12.745	2.017	16.580	10.678	8.866	0.063
6	4,523,960,320	0.033	0.015	5.966	11.271	2.039	15.970	10.495	8.492	0.060
7	3,654,947,328	0.029	0.013	5.333	10.045	2.044	15.895	10.264	8.755	0.061
8	3,081,091,072	0.026	0.014	4.609	8.470	2.073	15.413	10.204	8.360	0.059
9	2,617,196,800	0.024	0.012	3.886	7.031	2.091	15.109	10.127	8.235	0.059
High	2,309,423,616	0.019	0.012	2.985	5.240	2.151	14.206	10.685	7.368	0.055
High-Low	-9.287e+10***	-0.271***	-0.169***	-15.24***	-32.78***	0.421***	-7.825***	-3.036***	-4.286***	-0.0398***
T-Statistic	(-27.63)	(-34.69)	(-21.09)	(-14.82)	(-14.83)	(18.26)	(-9.008)	(-7.826)	(-5.393)	(-7.471)

Note: The brackets are the t-statistic calculated using the robust standard error of Newey-West (1987) with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. This article is divided into 10 groups according to the Amihud level from low to high in the s-1st month. Low represents the combination with the lowest Amihud indicator, High represents the combination with the highest Amihud indicator, and 2 to 9 represent the other 8 according to the Amihud indicator from low to high. Portfolios are divided equally. s is the number of all months in the sample period of this paper. Unless otherwise specified, the calculation method of each indicator is to take the average of all stocks in the portfolio in the s-1st month, and then take the average of all months. Companysize: Total assets; Big4: Whether the auditors are from the Big Four accounting firms; Outside: Whether the auditors are from overseas accounting firms; Anaaattention: Analysts' attention (number); Reportattention: Research reports' attention (articles); Companyopacity : Transparency of listed companies, disclosed by the Shanghai Stock Exchange and Shenzhen Stock Exchange, on a scale of 1 to 4, with 1 representing the highest transparency and 4 representing the worst transparency; Negshrcr1: Shareholding ratio of the company's largest tradable shareholder (%); Negshrs: Company The sum of the shareholding ratios of the second-largest tradable shareholders to the tenth-largest tradable shareholders; Negshrz: the ratio of the company's largest tradable shareholders to the second-largest tradable shareholders; Negshrh10: the shareholding concentration of Herffin Dahl Index, the sum of the squares of the shareholding ratios of the top 10 tradable shareholders of the company. Data source: GTA CSMAR database.

3.2.7 The low-Amihud-portfolio with negative return: Are investors rational?

Although the low Amihud portfolio consistently produces negative excess returns, it should be noted that the negative expected return of the portfolio cannot directly lead to the conclusion of "investor irrationality.” A variety of reasons, such as hedging, moral hazard issues of fund managers, and investors' gambling behavior, can support the coexistence of "rational investors" and "negative portfolio returns." Combined with the reality of the A-share market, this article excludes these three possible explanations that may support investors to rationally hold low Amihud portfolios.

3.2.7.1 Hedging

If an investor holding a low Amihud portfolio takes a hedging period, they can profit from the underlying futures or options even as the value of the stock falls. Therefore, they are willing to hold low Amihud portfolios with negative expected returns. However, the stock index futures in the A-share market were launched in 2010, and the other 50ETF options only started trading in 2015, and the low Amihud portfolio has been generating negative excess returns throughout the research period, so “hedging” cannot fully explain the low Amihud portfolio. negative returns.

3.2.7.2 Moral hazard of fund managers

Moral hazard issues for fund managers can lead to asset price bubbles. In the case of information asymmetry and contract friction between investors and fund managers, fund managers may trade stocks at a price higher than the fundamental value of the company, and the risk is borne by investors. However, the investors in the A-share market are mainly retail investors, and the stock market value and trading volume of securities investment funds account for a small proportion of the entire market. Therefore, the moral hazard issue of fund managers will not be the dominant factor in the persistent negative returns of the low Amihud portfolio.

3.2.7.3 Gambling behavior of investors

In addition, investors may buy the low Amihud combination as a lottery ticket. Although the expected return of lottery is negative, it is very popular. In general, people who buy lottery tickets pay less than they get, but they have the opportunity to win a large amount for a small amount. The probability of this high return can be measured by the skewness of the distribution of expected returns. If the skewness of expected returns gives investors utility, they will behave rationally even if expected returns are negative.

So, does the low Amihud combination have lottery properties? To answer this question, this

paper compares the return level and return skewness from month -5 to month 5 for ten portfolios sorted by Amihud. This paper uses two methods to measure the skewness of portfolio returns: one is the skewness of the percentage return distribution of stocks in the portfolio, and the other is the skewness of the time series of the average return of the portfolio. The first skewness characterizes the investor's likelihood of generating large returns when holding individual stocks in the portfolio, while the second skewness measures the investor's likelihood of generating large returns when holding the entire portfolio.

Tables 15 and 16 compare the average return and transaction value of each portfolio in the 11 months centered on month 0, respectively. This paper uses the following method to calculate the average return: first average the percentage returns of the stocks in the portfolio in each month to obtain a monthly time series of returns, convert them into logarithmic returns, and then take the average of all months The average return thus obtained represents the average compound return over time.

From the -5th month to the -2nd month, the returns of the high-Amihud portfolio were lower than those of the low-Amihud portfolio. The stock price of Amihud has experienced a period of rapid rise, but from the -1st month to the 5th month, the yield level of the low Amihud portfolio is lower than that of the high Amihud portfolio. The low Amihud portfolio has a negative return in month 0, and the return level fluctuates around 0 in the following months, while the monthly return level of the high Amihud portfolio remains between 1% and 3%.

Table 17 shows the skewness of stock percentage returns within each portfolio from month -5 to month 5. The skewness of the percent returns within the portfolio is all positive. This makes sense because the monthly percentage return theoretically has a minimum value of -1 and a maximum value that can reach very high levels, so it exhibits positive skewness. From the -5th month to the -2nd month, the intra-portfolio skewness of the low Amihud portfolio was greater than that of the high Amihud portfolio. Beginning in month -1, the situation reversed, with the within-group skewness of the high-Amihud combination exceeding that of the low-Amihud combination. In addition, from the -1st month to the 5th month, the within-group skewness difference between the high Amihud combination and the low Amihud combination was significantly positive at the 5% level.

This article focuses on the skewness in month 0. If investors bought stocks in the low-Amihud portfolio at the beginning of 0 to gamble, then the returns of the low-Amihud portfolio in month 0

should exhibit greater within-portfolio skewness. In fact, the within-group skewness of the returns of the low Amihud portfolio in month 0 is significantly lower than that of the high Amihud portfolio at the 1% level. This shows that stocks with a low Amihud portfolio have a smaller chance of making big gains than holding a high Amihud portfolio. The above empirical results contradict the claim that investors gamble by holding low Amihud portfolios.

Considering Table 15, Table 16, and Table 17 together, this article provides another possible explanation. Investors observed the phenomenon of high return level and return skewness in the low Amihud portfolio from -5th to -2nd month, thus forming a wrong expectation for the return distribution of stocks in the low Amihud portfolio, and so buy stocks with low Amihud portfolios, as evidenced by the surge in turnover in the -1st month. However, the stocks in the low Amihud portfolio did not deliver the yield and skewness investors expected, and after investors' expectations were dashed, the stock price and trading volume began to continue to decline.

In addition, Table 18 compares the skewness of the average returns of each portfolio on the time series. The calculation method is: first take the average of the percentage returns of the stocks in the portfolio in each month to obtain a monthly return time series, convert it into a logarithmic return, and then calculate the skewness of this return time series.

In general, the skewness of the average returns of each portfolio is negative, which is consistent with the empirical characteristic of the left-biased logarithmic returns of stocks, and shows that the distribution of the average returns of the portfolios does not conform to the characteristics of the lottery, because the expected return distribution of the lottery skewness should be positive. In addition, from the -5th month to the fifth month, the return skewness of the high Amihud portfolio is higher than that of the low Amihud portfolio. If investors hold the entire portfolio equally, the low Amihud portfolio is more likely to generate extreme negative returns than the high Amihud portfolio. This further rules out the possibility of "investor gambling" while providing new evidence of "mispricing" of low Amihud portfolios.

Table 15: Returns before and after portfolio entry with different Amihud levels

Amihud-decile	L5r	L4r	L3r	L2r	L1r	R0	F1r	F2r	F3r	F4r	F5r
Low	0.021	0.021	0.023	0.030	0.016	-0.001	0.000	0.000	0.000	-0.002	-0.002
2	0.019	0.018	0.021	0.027	0.017	0.001	0.002	0.003	0.002	-0.001	-0.001
3	0.015	0.016	0.017	0.022	0.015	0.005	0.005	0.003	0.002	0.002	0.001
4	0.016	0.014	0.014	0.015	0.011	0.006	0.007	0.007	0.006	0.004	0.003
5	0.012	0.012	0.013	0.012	0.010	0.010	0.009	0.007	0.008	0.006	0.004
6	0.013	0.012	0.011	0.008	0.009	0.012	0.010	0.010	0.010	0.007	0.006
7	0.010	0.010	0.009	0.006	0.007	0.017	0.014	0.012	0.010	0.007	0.007
8	0.010	0.009	0.006	0.001	0.006	0.017	0.015	0.013	0.011	0.010	0.009
9	0.008	0.007	0.005	-0.001	0.004	0.022	0.018	0.014	0.013	0.011	0.010
High	0.011	0.008	0.006	-0.001	0.022	0.029	0.019	0.017	0.014	0.012	0.011
High-Low	-0.00894	-0.0111**	-0.0151***	-0.0294***	0.00912	0.0317***	0.0208***	0.0184***	0.0160***	0.0157***	0.0145***
T-Statistic	(-1.611)	(-2.027)	(-2.640)	(-4.865)	(1.042)	(6.109)	(4.199)	(3.970)	(3.268)	(3.186)	(3.009)

Note: The brackets are the t-statistic calculated using the robust standard error of Newey-West (1987) with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. This article is divided into 10 groups according to the level of Amihud from low to high in the s-1st month. Low represents the combination with the lowest Amihud index, High represents the combination with the highest Amihud index, and 2 to 9 represent the other 8 groups from low to high according to the Amihud index. Portfolio divided equally; s is the number of all months in the sample period of this paper. L5r represents the average return of each portfolio in the -5th month. In this paper, the percentage return of each stock in the portfolio is averaged in the s-5th month, and the average return of the portfolio is converted into a logarithmic return. The month is averaged, and the sign of the month is changed from s-5th to -5th month. Similarly, L4r, L3r, L2r and L1r represent the average returns of each portfolio in months -4, -3, -2 and -1, respectively, and R0 represents the average return of each portfolio in month 0 rate, F1r, F2r, ..., F5r represent the average returns of each portfolio in the first month, the second month, the ... and the fifth month, respectively.

Table 16: The transaction amount before and after the entry of portfolios with different Amihud levels (100 million yuan)

Amihud-decile	L5trade	L4trade	L3trade	L2trade	L1trade	Trade0	F1trade	F2trade	F3trade	F4trade	F5trade
Low	86.0	88.1	90.3	94.4	96.6	90.5	87.3	85.5	84.1	82.7	81.4
2	42.5	43.0	43.3	44.2	44.8	42.7	42.0	41.7	41.3	40.9	40.4
3	30.3	30.3	30.4	30.6	30.5	29.8	29.7	29.5	29.4	29.3	29.5
4	24.2	24.2	23.9	23.5	23.1	23.0	23.3	23.4	23.5	23.8	23.7
5	20.2	20.0	19.6	19.0	18.6	18.9	19.3	19.7	19.9	20.2	20.2
6	17.1	16.8	16.4	15.9	15.3	16.0	16.5	16.9	17.3	17.5	17.8
7	14.6	14.3	13.9	13.1	12.5	13.4	14.2	14.6	15.0	15.3	15.6
8	12.5	12.2	11.7	11.0	10.2	11.3	12.0	12.5	12.9	13.2	13.4
9	10.3	9.99	9.58	8.75	8.19	9.45	10.1	10.7	11.1	11.4	11.7
High	8.98	8.52	8.07	6.47	8.24	12.4	11.8	11.6	11.7	11.8	11.9

Note: This article is divided into 10 groups according to the Amihud level from low to high in the s-1st month. Low represents the combination with the lowest Amihud indicator, High represents the combination with the highest Amihud indicator, and 2 to 9 represent the other 8 according to the Amihud indicator from low. To a portfolio with a high average division, s is the number of all months in the sample period of this paper. L5trade represents the average transaction value of each portfolio in the -5th month, in units of 100 million yuan. In this paper, the transaction value of each stock in the portfolio is averaged in the s-5th month, and then averaged over all months. s-May becomes s-May. Similarly, L4trade, L3trade, L2trade and L1trade represent the average transaction value of each portfolio in month -4, -3, -2 and -1 respectively, and Trade0 represents the average transaction of each portfolio in month 0 Amount, F1trade, F2trade, ..., F5trade represent the average transaction value of each combination in the first month, the second month, the ... and the fifth month.

Table 17: Within-Portfolio Percentage Return Skewness for Different Amihud Levels

Amihud-decile	Skew_L5	Skew_L4	Skew_L3	Skew_L2	Skew_L1	Skew_0	Skew_F1	Skew_F2	Skew_F3	Skew_F4	Skew_F5
Low	1.1223	1.1733	1.1658	1.1495	0.9119	0.7976	0.8204	0.8038	0.7773	0.7809	0.7663
2	1.1552	1.1440	1.1022	1.0724	0.9048	0.9229	0.8526	0.8632	0.8354	0.8260	0.8551
3	1.0415	1.1330	1.1433	1.0221	0.9199	0.8812	0.9747	0.9170	0.9042	0.9063	0.8640
4	1.1011	1.0943	1.0733	0.9450	0.8914	0.9516	0.9453	0.9277	0.9840	0.9284	0.9177
5	1.0708	1.0604	0.9864	0.9757	0.9574	1.0732	0.9646	0.9204	0.9237	0.9094	0.8602
6	1.0629	1.0523	0.9832	0.8805	0.9680	1.0340	0.9681	0.9636	0.9906	0.8529	0.8989
7	0.9841	0.9705	0.9449	0.8528	0.9541	1.0080	1.0086	0.9572	0.9279	0.9486	0.9660
8	0.9774	0.9259	0.9230	0.7281	0.8958	1.0019	0.9897	0.9554	0.9661	0.9845	0.9972
9	0.9645	0.9253	0.8658	0.7591	1.0362	1.1057	1.0228	0.9460	0.9713	0.9906	0.9734
High	0.9105	0.8774	0.7914	0.8249	1.3406	1.1650	0.9762	0.9614	0.9588	0.9558	0.9279
High-Low	-0.212**	-0.294***	-0.374***	-0.328***	0.428***	0.369***	0.155**	0.157**	0.181***	0.175***	0.162**
T-Statistic	(-2.535)	(-3.402)	(-4.544)	(-4.743)	(3.123)	(3.846)	(2.144)	(2.461)	(2.622)	(2.959)	(2.605)

Note: This article is divided into 10 groups according to the Amihud level from low to high in the s-1st month. Low represents the combination with the lowest Amihud indicator, High represents the combination with the highest Amihud indicator, and 2 to 9 represent the other 8 according to the Amihud indicator from low. To a portfolio with a high average division, s is the number of all months in the sample period of this paper. Skew_L5 represents the mean of the percentage return skewness of each portfolio in the -5th month. In this paper, the skewness of the percentage return of each stock in the portfolio is taken in the s-5th month, and then the average is taken for all months. The notation changed from s-5th to -5th. Similarly, Skew_L4, Skew_L3, Skew_L2, and Skew_L1 represent the mean value of the percent return skewness within the portfolio in the -4th, -3rd, -2nd, and -1st months, respectively, and Skew_0 represents the mean value of the percent return skewness in the portfolio in month 0, Skew_F1, Skew_F2, ..., Skew_F5 represent the percent return skewness in the portfolio in the first month, the second month, ... and the fifth month, respectively degree mean.

Table 18: Time series skewness of average returns for portfolios with different Amihud levels

Amihud-decile	Skew_L5_T	Skew_L4_T	Skew_L3_T	Skew_L2_T	Skew_L1_T	Skew_0_T	Skew_F1_T	Skew_F2_T	Skew_F3_T	Skew_F4_T	Skew_F5_T
Low	-0.555	-0.569	-0.587	-0.695	-0.603	-0.522	-0.593	-0.640	-0.619	-0.718	-0.706
2	-0.593	-0.551	-0.568	-0.594	-0.528	-0.551	-0.538	-0.581	-0.543	-0.676	-0.629
3	-0.492	-0.572	-0.514	-0.518	-0.541	-0.471	-0.498	-0.563	-0.531	-0.639	-0.655
4	-0.439	-0.485	-0.431	-0.464	-0.512	-0.503	-0.466	-0.518	-0.465	-0.632	-0.610
5	-0.500	-0.453	-0.408	-0.514	-0.486	-0.489	-0.548	-0.516	-0.545	-0.630	-0.618
6	-0.435	-0.391	-0.463	-0.508	-0.451	-0.446	-0.505	-0.489	-0.526	-0.566	-0.578
7	-0.485	-0.435	-0.430	-0.360	-0.455	-0.437	-0.486	-0.440	-0.471	-0.543	-0.588
8	-0.469	-0.423	-0.444	-0.360	-0.384	-0.429	-0.472	-0.482	-0.421	-0.549	-0.535
9	-0.432	-0.392	-0.412	-0.324	-0.346	-0.364	-0.413	-0.397	-0.411	-0.507	-0.502
High	-0.381	-0.359	-0.313	-0.233	-0.171	-0.354	-0.360	-0.431	-0.497	-0.511	-0.546
High-Low	0.174	0.211	0.274	0.462	0.432	0.168	0.234	0.210	0.122	0.207	0.160

Note: This article is divided into 10 groups according to the Amihud level from low to high in the s-1st month. Low represents the combination with the lowest Amihud indicator, High represents the combination with the highest Amihud indicator, and 2 to 9 represent the other 8 according to the Amihud indicator from low. To a portfolio with a high average division, s is the number of all months in the sample period of this paper. Skew_L5_T represents the skewness of the average return of each portfolio in the -5th month. In this paper, in the s-5th month, the average percentage return of each stock in the portfolio is taken, and the average return of the portfolio is converted into a logarithmic return. , and then find the skewness of the monthly portfolio return, and the sign of the month changes from s-5th to -5th. Similarly, Skew_L4_T, Skew_L3_T, Skew_L2_T and Skew_L1_T represent the skewness of the average returns of the portfolios in the -4th, -3rd, -2nd and -1st months, respectively, and Skew_0 represents the 0th The skewness of the monthly average return of the portfolio, Skew_F1, Skew_F2, ..., Skew_F5 represent the skewness of the average return of the portfolio in the first month, the second month, ... and the fifth month, respectively.

3.2.8 Event-study analyses: cumulative returns and traded volumes' trends of high-Amihud-portfolio and low-Amihud-portfolio

In addition to the "vertical" comparison of the characteristics of each portfolio, the paper also uses the event study method to conduct a "horizontal" analysis of the stock returns and turnover trends of each portfolio. The event study method is a classic method in the asset pricing literature. One of its obvious advantages is that it can intuitively display the trend of stock prices and turnover before and after a specific event, so as to clarify the cause and effect of the event. For the purposes of this article, this particular event is an abnormal return of the portfolio in month 0. Take the combination with the lowest Amihud last month as an example, through event research and analysis, this paper clearly shows its return rate trend and transaction volume change before it achieved negative returns in the 0th month, and based on this, it verifies a series of asset pricing theories, and then finds The reason for the negative returns of the low Amihud portfolio can also be seen whether the negative returns of the low Amihud portfolio are persistent in subsequent months.

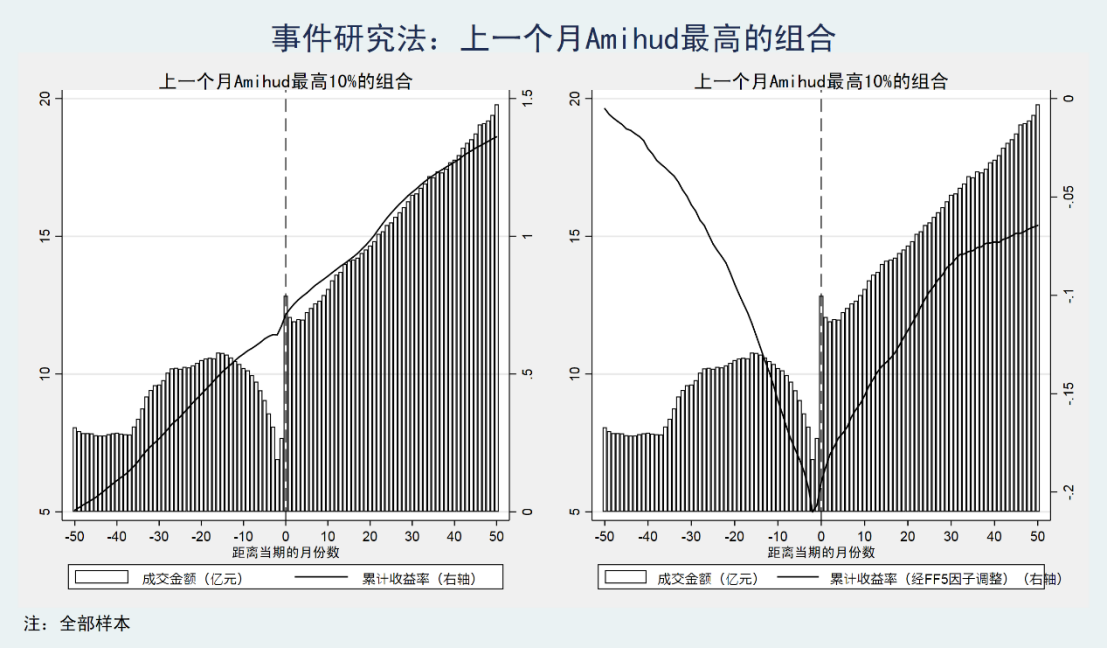

Figure 6: Cumulative yield and turnover trend of high Amihud portfolios last month

This paper first selects the highest 10% stocks of Amihud in the s-1st month to form a high-Amihud portfolio, and then calculates the monthly average percentage rate of return and average

transaction amount of the high-Amihud portfolio from the s-50th month to the s+50th month. Convert the average rate of return to logarithmic rate of return, and finally average all the months s, and the month number from s-50th to s+50th month correspondingly changes to -50th month to 50th month (pairs After taking the average of all months s, the yield and transaction amount no longer depend on the specific month s). Months that are not within the study period of this paper are treated as missing values. The reason why the monthly rate of return is converted into a logarithmic rate of return and then averaged over all months is because this article wants to examine the average compound rate of return between different months. In addition, the cumulative rate of return is obtained by accumulating the rate of return from the -50th month.

Figure 6 shows the trend of cumulative returns and transaction value of the high Amihud portfolio in 101 months centered on month 0. The solid line on the left is the cumulative rate of return without risk adjustment. From the -50th month to the -8th month, the cumulative yield and transaction value of the high Amihud portfolio increased at the same time. However, from month -8 onwards, transaction value declined rapidly and reached its lowest point for the entire event study window in month -1. At the same time, from the -8th month, the growth rate of the cumulative yield also slowed down, and it also fell in the -1st month. In the following month 0, turnover quickly recovered to a higher level than before, while the high Amihud portfolio recorded the largest single-month gain in the entire event study window. The cumulative yield curve that previously held the high Amihud portfolio on a monthly basis continued to move upward precisely because the 0th month of positive returns were continuously captured. After that, the cumulative rate of return and the transaction volume rose simultaneously. By the 50th month, the cumulative rate of return rose to about 1.4, and the transaction volume also reached the level of 2.3 billion.

The chart on the right shows the trend of cumulative returns adjusted by the FF5 factor. The steps to adjust the stock return in this paper are as follows: first perform a time series regression on the return of each stock against the FF5 factor to obtain the estimated value of each risk factor coefficient and intercept term, and then subtract the stock risk premium for each month The intercept term and the product of the current month's risk factor realized value and the risk factor coefficient are used to obtain the risk-adjusted rate of return, and the previous event study analysis is repeated. This processing method can remove various risk factors that have been shown to affect stock returns in the literature and the heterogeneity of individual stock returns that do not change over time from stock returns, thereby more clearly showing the high Amihud portfolio around

month 0 unusual changes in yields.

The adjusted cumulative yield continued to decline from the -50th month to the -1st month, and the decline rate from the -50th month to the -8th month was relatively slow, and the transaction volume during the same period continued to increase. However, from the -8th month, the cumulative rate of return accelerated to decline, accompanied by a rapid decline in transaction value. In month -1, both turnover and cumulative returns reached their lowest points within the event study window. Yields then reversed in month 0 and recorded the largest one-month abnormal return (~2%) in the entire window. Subsequently, the cumulative yield maintained an upward trend, and the rate of increase did not slow down until the 30th month. Stocks in high Amihud portfolios have generally experienced rapid stock price declines and shrinking turnover, and investors are often reluctant to hold these stocks, so they receive higher returns as compensation, which is similar to "illiquidity compensation." The explanation is consistent.

Considering that the same stock may be selected into the highest Amihud portfolio for multiple consecutive months, this will make the stock's movements in different months superimposed, such as the decline in month -1 and the rise in month 0 offset each other, thus Affect the trend of cumulative returns. In order to relieve this concern, this paper removes the samples in which the same stock in the high Amihud portfolio is separated by less than or equal to 10 months. If the same stock enters the high Amihud portfolio with a gap of less than 10 months, the first observation is taken. In the appendix, this paper provides the results of the event research analysis after excluding the above samples. The trend of cumulative return and transaction amount is similar to that when using all the samples, which shows that the findings of this paper are robust.

In addition to the high Amihud combination, an event study analysis was also performed on the low Amihud combination. The left side of Figure 7 shows the unadjusted cumulative return and transaction value of the low Amihud portfolio from month -50 to month 50. From the -50th month to the -1st month, the cumulative yield rose linearly, and the transaction volume also showed an upward trend, and it accelerated from the -15th to the -1st month. From the 0th month, the upward trend of the cumulative return came to an abrupt end, and the cumulative return for the next 15 months was negative, and the slow upward trend only resumed from the 15th month. Month 0 is also the inflection point of the transaction value. From the 0th month to the 10th month, the transaction value fell rapidly, and then fluctuated at a nearby level.

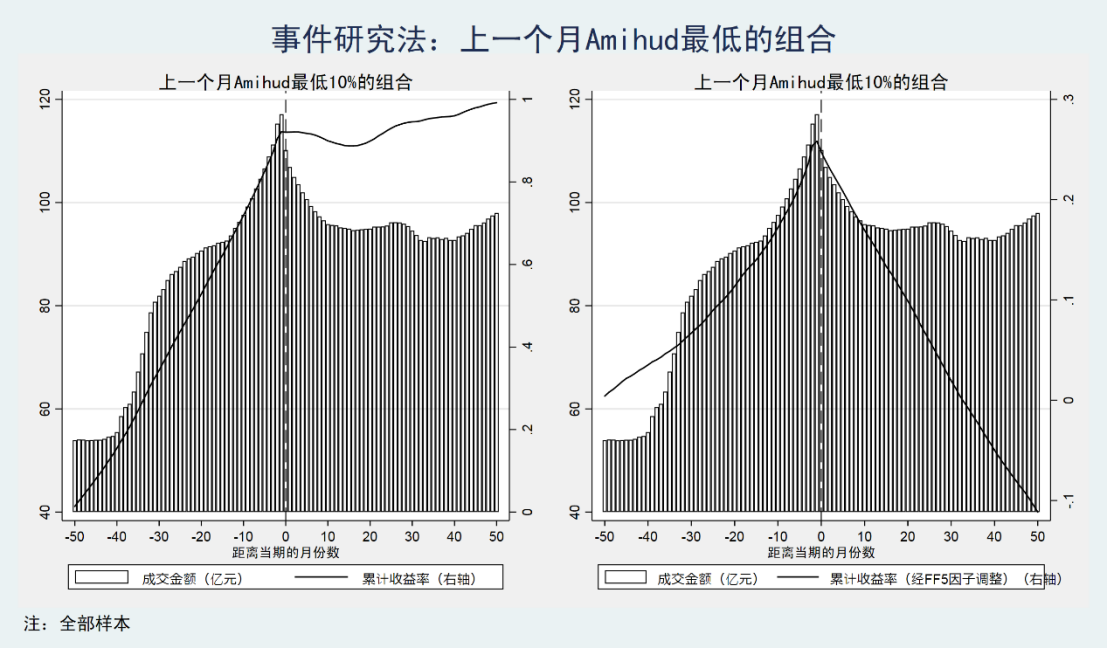

Figure 7: The cumulative return and turnover of the low Amihud portfolio last month

The right side of Figure 7 shows the trend of cumulative yield and transaction amount adjusted by the FF5 factor. The adjustment method is the same as the high Amihud combination. From the -50th month to the -1st month, the cumulative yield showed an accelerated upward trend. However, from month 0, the cumulative yield began to reverse downward and continued to decline for the next 50 months. Previously, this article pointed out that the monthly holding of the stock portfolio with the lowest Amihud in the previous month will get a straight downward cumulative yield curve (after risk adjustment), because the negative return corresponding to the 0th month in the figure is obtained in each month. The findings of this paper are consistent.

The low-Amihud portfolio first experienced a simultaneous and rapid rise in cumulative yield and transaction value, and then both reversed downward at the same time, which is very similar to the expression of investor "overreaction" in the literature. On the theoretical side, the model of Hong and Stein (1999) [49] proves that carry trades by momentum traders can lead to an "overreaction" of stock prices. Based on the analysis of the situation in this article, the continuous rise of the stock price of the low Amihud portfolio before month 0 is indeed very attractive to momentum traders, and the turnover is also increasing, so the stock price "overreacts," and the subsequent cumulative returns continue to fell. Therefore, the empirical results of this paper are in good agreement with the theoretical predictions of Hong and Stein (1999) [49]. In addition, in

terms of empirical research, Han Qian and Hong Yongmiao (2014) [54] pointed out that institutional investors profited from the “overreaction” of retail investors to industrial policies by analyzing the data of investors’ accounts on the Shanghai Stock Exchange, and there was a “return of income” before and after the announcement of industrial policies. turn" phenomenon. In addition, Li Xindan et al. (2014) [55] also pointed out that individual investors will have an "overreaction" to the "high transfer" of listed companies, leading to the inversion of yield. This is very similar to the empirical results in this paper. Therefore, a lower Amihud indicator may be capturing information that investors are trading irrationally, resulting in lower returns. Based on the above analysis, this paper believes that there is "mispricing" in the low Amihud portfolio, and the negative return of the low Amihud portfolio is caused by the "overreaction" of investors.

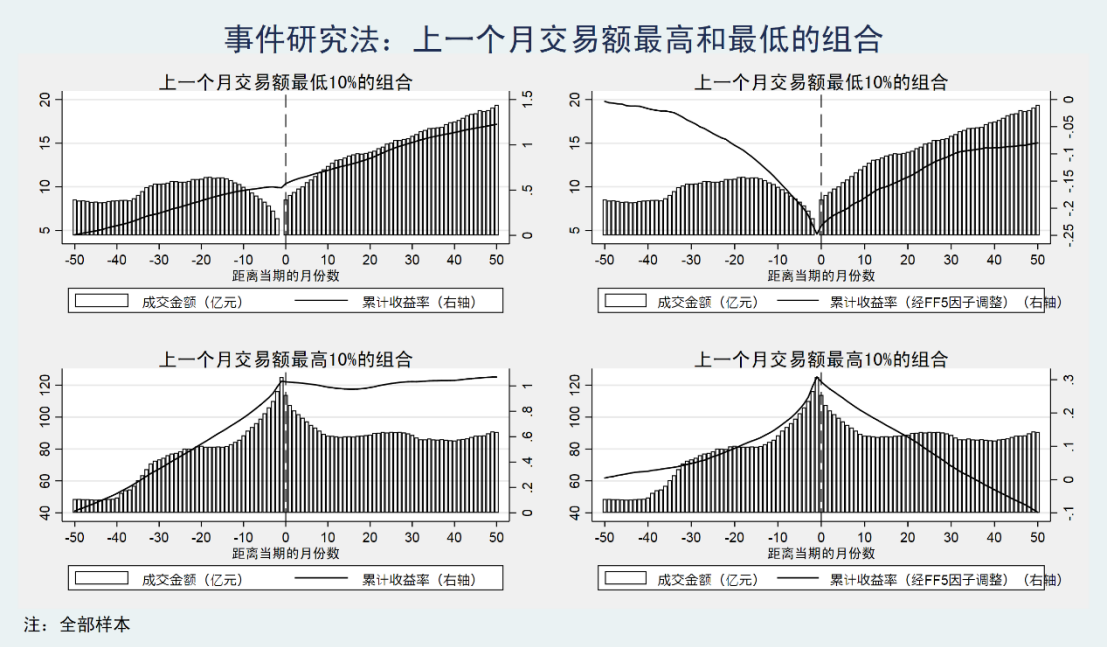

Figure 8: Cumulative return and turnover trend of the portfolio with high and low transaction value in the last month

Similarly, in order to avoid the same stock continuously entering the low Amihud portfolio and causing the return trend to overlap, this paper reports in the appendix the results of the event study analysis that only retains samples of the same stock that are separated by more than 10 months. As with the full sample, cumulative returns and turnover show a clear pattern of "overreaction.” Therefore, the conclusions of this paper are very robust.

The paper also conducts an event-study analysis of the portfolio of stocks that traded in the

top 10% and the bottom 10% over the past month. The results are shown in Figure 8. Among them, the trend of cumulative yield and transaction value of the portfolio with high transaction value is similar to that of the portfolio with low Amihud, while the situation of the portfolio with low transaction value is similar to that of the portfolio with high Amihud. This shows that the information described by the Amihud indicator, and the transaction amount has a certain similarity, which confirms the conclusion that only the transaction amount component of the Amihud indicator is priced.

3.2.9 Double-sorting analyses: the identifications and tests of the formation mechanism of Amihud premium

In the analysis of the event study method, the "illiquidity compensation" of high Amihud portfolios and the "mispricing" of low Amihud portfolios have been shown very intuitively. On this basis, this paper also combines a series of asset pricing theories to analyze and test a series of inferences about the existence of "mispricing" in low Amihud portfolios or "illiquidity compensation" in high Amihud portfolios.

This paper uses the double-variable sorting method (Double Sorting) to test this inference. The specific steps are: firstly, divide all stocks into 5 groups according to the s-1st Amihud index from low to high, and then divide them into 5 groups from low to high according to other variables (such as turnover rate) in each group. After the grouping is completed, first take the average of the percentage returns of all stocks in the portfolio in the s-th month, and then take the average among different months. The paper also provides the t-statistic of the mean of returns for each group. In addition, the paper provides the FF5 factor-adjusted returns for each group and its t-statistic by regressing the monthly average returns for each group against the FF5 factor and reporting the coefficient and t-statistic for the intercept term.

This paper believes that the analysis method of bivariate ranking has three main advantages: First, in the horizontal comparison of the same row, under the control of the first variable (Amihud indicator), stock returns vary with the second variable (such as turnover rate). or volatility); second, longitudinal comparisons across rows reveal patterns about the relationship between the second variable and future stock returns as a function of the first variable; third, in contrast to the linear model, the bivariate ranking method can see the nonlinear change of the expected return of the stock with the variable, as well as the interaction between the two variables.

The theory of Harrison and Kreps (1978) [47] points out that two important preconditions for "mispricing" are heterogeneous beliefs among investors and short selling constraints. The situation of the A-share market satisfies these two assumptions. First of all, investors in the A-share market have very different understandings of various factors such as company fundamentals, macroeconomic conditions, and national policies. One of them is the frequent transactions and the turnover rate is much higher than that of the U.S. stock market. In addition, there are obvious short selling restrictions in the A-share market. Although the securities lending trading system was introduced in 2010, the proportion of securities lending trading volume to the total market trading volume is very small, and the balance of securities lending is negligible compared with the overall circulating market value of A shares. Therefore, there is a theoretical basis for the existence of "mispricing" in the low Amihud portfolio.

In addition, Scheinkman and Xiong (2003) [8] believe that the size of asset price bubbles is positively related to transaction frequency. This article uses turnover to measure trading frequency. Also, the bigger the asset price bubble, the lower the future returns should be. Therefore, this paper draws the inference that in the low Amihud portfolio, the expected return decreases with the increase in turnover.

Table 19 reports the analysis results of the bivariate ranking of Amihud metrics and turnover, in which different rows represent groups on Amihud metrics and different columns represent groups on turnover. Among them, panel 1 reports the mean and corresponding sum t value of the percentage return, DIF is the difference between the returns of the portfolio with the highest turnover rate and the portfolio with the lowest turnover rate in the same Amihud group, and T_DIF is the t statistic of DIF. Panel 2 shows the mean returns and t-statistics for each group adjusted by the FF5 factor. The numbers in the table are annualized percentage returns, calculated by multiplying the monthly percentage returns by 12, without compounding.

In the group with the lowest Amihud, the portfolio returns decrease with the increase of turnover, and the annualized return of the group with the highest turnover is -8%, which is 18.68 lower than that of the portfolio with the lowest turnover. %, this difference is significant at the 1% level, which is consistent with the previous inference.

In addition, among the portfolios with the highest Amihud metrics, the returns of the portfolios with the highest turnover rate are also significantly lower than those with the lowest turnover rate. Since turnover is also a liquidity indicator, the higher the turnover, the more liquid the stock is

generally, while the group with the lowest turnover will demand higher returns due to its poor liquidity. This result does not contradict the existence of "illiquidity compensation" for high Amihud combinations.

Table 19: Bivariate ranking analysis of Amihud indicator and turnover rate

Amihud_Turnover	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	10.44	15.03	9.25	5.65	-8.24	-18.68	1.19	1.47	0.84	0.48	-0.67	-2.83
2	16.21	19.52	18.25	13.76	2.49	-13.71	1.71	1.76	1.60	1.16	0.20	-2.29
3	19.90	23.78	23.81	21.05	13.74	-6.15	2.04	2.12	2.05	1.74	1.08	-1.09
4	25.31	32.20	28.93	28.45	24.59	-0.72	2.49	2.83	2.49	2.31	1.90	-0.13
5	50.84	35.36	40.31	34.73	29.79	-21.05	4.87	3.08	3.37	2.84	2.27	-3.09
Amihud_Turnover	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	2.36	3.12	-6.75	-11.75	-28.23	-30.59	1.08	1.08	-2.24	-3.44	-6.19	-6.49
2	1.05	-1.91	-4.59	-10.82	-24.92	-25.96	0.33	-0.64	-1.55	-3.68	-6.27	-5.63
3	1.25	-0.24	-2.30	-5.92	-17.51	-18.75	0.41	-0.09	-0.92	-2.32	-4.60	-4.67
4	3.89	6.04	2.17	-1.59	-7.00	-10.90	1.37	2.56	1.00	-0.61	-1.87	-2.42
5	27.95	9.51	11.79	5.59	-2.17	-30.12	5.87	3.56	5.35	2.05	-0.49	-5.03

Note: Amihud_Turnover means to first group by Amihud indicators and display them in different rows, and then group them by Turnover and display them in different columns. Lines 1-5 represent the 5 combinations from low to high by the Amihud indicator, respectively, and R1-R5 represent the 5 combinations from low to high by Turnover in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

After the adjustment of the FF5 factor, the yield gap between the high turnover portfolio and the low turnover portfolio is more obvious. In the low Amihud portfolio, the yield gap between the two rose to 30.6% with a t-value of -6.5. It is worth mentioning that the return rate of the portfolio with the highest turnover rate in the low Amihud portfolio is -28.2%, and the t value reaches -6.2. This huge negative return is strong evidence of "mispricing." The above empirical results consolidate the conclusions of this paper.

Another corollary of Scheinkman and Xiong (2003) [8] is that the degree of "mispricing" increases with volatility. Therefore, this paper conducts a bivariate grouping of the Amihud indicator and stock price volatility to test this inference. The results are shown in Table 20.

Among the low Amihud portfolios, the average return of the portfolio with the highest share price volatility is 18.3% lower than that of the portfolio with the lowest volatility, which is significant at the 1% level (t-value -2.76). In addition, after adjustment by the FF5 factor, the yield

gap between the portfolio with the highest volatility and the portfolio with the lowest volatility widened to 22.5%, and the t value also became -4.4. This empirical result confirms the previous inference.

In order to verify that the high returns of high Amihud portfolios come from "illiquidity compensation," this paper examines the relationship between stock returns and relative spreads in high Amihud portfolios. The relative spread is a direct measure of stock transaction costs extracted from order book data and is often used as a benchmark for liquidity indicators (Goyenko et al, 2009 [11]; Zhang Zheng et al, 2013 [12]). A larger relative spread means higher transaction costs and less liquid stocks, requiring higher returns as compensation. Thus, this paper gets another inference: in the high Amihud portfolio, the expected return of the stock increases as the relative spread becomes larger.

Table 20: Amihud Indicator and Volatility Bivariate Ranking Analysis

Amihud_Volatility	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	13.65	11.32	6.67	5.05	-4.68	-18.33	1.49	1.10	0.59	0.44	-0.39	-2.76
2	19.18	15.77	14.94	13.41	6.89	-12.29	1.94	1.45	1.29	1.15	0.56	-2.14
3	20.12	22.38	23.58	20.29	15.92	-4.20	1.97	2.04	2.02	1.67	1.27	-0.76
4	27.35	28.14	28.80	29.43	25.72	-1.64	2.59	2.50	2.45	2.44	2.00	-0.29
5	33.37	35.86	38.63	38.13	45.04	11.67	3.04	3.14	3.22	3.12	3.62	1.88
Amihud_Volatility	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	2.35	-2.63	-9.47	-11.49	-20.14	-22.50	0.88	-0.90	-3.13	-2.94	-4.62	-4.42
2	0.22	-6.04	-8.35	-9.56	-17.51	-17.73	0.07	-2.17	-2.89	-3.10	-4.03	-3.68
3	-1.55	-1.44	-2.07	-6.91	-12.73	-11.18	-0.58	-0.59	-0.73	-2.31	-3.09	-2.57
4	3.15	2.27	0.55	1.67	-4.15	-7.29	1.25	1.05	0.22	0.70	-0.95	-1.48
5	8.97	10.23	10.14	8.76	14.57	5.60	3.31	4.30	4.46	2.84	2.61	0.92

Note: Amihud_Volatility means to first group by Amihud indicators and display them in different rows, and then group them by Volatility and display them in different columns. Lines 1-5 represent the 5 combinations from low to high by the Amihud indicator, respectively, and R1-R5 represent the 5 combinations from low to high by Volatility in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

This paper reports the results of the bivariate ranking analysis of the Amihud indicator and relative spread in Table 21. In the high Amihud portfolio, the stock returns show an increasing trend as the relative spread increases. The average return of the group with the smallest relative spread is 21.64%, while the return of the group with the largest relative spread is 56.47%. A

difference of 34.83% (significant at the 1% level). This is consistent with the inference of this paper.

In addition, in the low Amihud portfolio, the yield gap between the high relative spread portfolio and the low relative spread portfolio is 6.44%, but it is not statistically significant, which indicates that the "illiquidity compensation" in the low Amihud portfolio does not determine the rate of return main factor.

Table 21: Bivariate ranking analysis of Amihud indicator and relative spread

Amihud_Rpd	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	2.86	5.83	7.84	6.12	9.38	6.53	0.27	0.55	0.71	0.56	0.88	1.13
2	9.38	12.51	15.06	16.59	16.76	7.38	0.83	1.10	1.34	1.48	1.52	1.62
3	15.15	19.50	23.99	22.16	21.52	6.37	1.32	1.68	2.09	1.93	1.92	1.41
4	20.68	28.16	28.80	32.00	29.89	9.21	1.77	2.42	2.45	2.73	2.61	1.97
5	22.10	35.42	38.11	38.94	56.52	34.43	1.84	3.02	3.20	3.25	5.00	6.28
Amihud_Rpd	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	-7.44	-9.15	-9.67	-10.85	-4.29	3.15	-2.14	-2.81	-2.98	-3.60	-1.55	0.82
2	-12.47	-10.12	-8.16	-6.02	-4.36	8.10	-3.26	-3.10	-2.80	-2.38	-1.53	2.09
3	-10.35	-7.71	-1.44	-3.55	-1.62	8.73	-2.82	-2.42	-0.56	-1.38	-0.59	2.04
4	-7.97	-0.36	0.94	4.95	6.01	13.98	-2.20	-0.14	0.41	2.15	2.08	3.12
5	-6.54	6.51	10.13	12.11	30.54	37.09	-1.79	2.25	4.00	4.31	6.67	6.48

Note: Amihud_Rpd means to first group by Amihud index and display them in different rows, and then group by Rpd and display them in different columns. Lines 1-5 represent the 5 combinations from low to high by Amihud index respectively, and R1-R5 represent the 5 combinations from low to high by Rpd in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

Furthermore, the theory of Hong et al (2006) [48] states that the degree of “mispricing” is negatively related to the number of shares outstanding. When the number of shares outstanding is larger, greater inter-investment heterogeneity beliefs are needed to offset the effect of pessimistic investors, so the degree of "mispricing" is reduced. Combined with the actual situation of the A-share market, because the prices of each stock are different, the comparability of the number of circulating shares is not strong, so the indicator used in this paper is the circulating market value. The larger the circulating market value, when the stock price is significantly higher than the fundamental value, there will be more pessimistic investors who will sell the stock in their hands, thereby offsetting the overvalued part of the stock price. On the other hand, according to the actual

situation of the A-share market, stocks with a large circulating market value are usually the subject of securities lending, so the degree of short-selling constraints is small. According to the above analysis, the smaller the circulating market value, the more likely the stock will be "mispriced," and the lower the future rate of return. Therefore, this paper draws the inference: in the low Amihud portfolio, the stock expected return increases with the increase of the float market value.

On the other hand, the circulating market value itself is also a commonly used liquidity indicator. The larger the circulating market value, the better the liquidity. According to the explanation of "illiquidity compensation," stocks with smaller market capitalization will receive excess returns as compensation due to poor liquidity. According to this, another inference is obtained in this paper: in the high Amihud portfolio, the expected return of the stock decreases with the increase of the float market value.

The above analysis shows that under the two different mechanisms of "illiquidity compensation" and "mispricing," the expected return of stocks will show a different relationship with the float market value. Using this, this paper can identify which mechanism mainly affects the returns of low-Amihud and high-Amihud portfolios.

Table 22: Bivariate ranking analysis of Amihud and circulating market capitalization

Amihud_Me	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	-2.92	8.92	9.18	9.04	7.95	10.86	-0.25	0.76	0.85	0.86	0.84	1.56
2	6.12	13.42	17.02	17.14	16.60	10.49	0.51	1.14	1.45	1.57	1.70	2.04
3	17.75	25.26	20.45	21.80	17.05	-0.70	1.42	2.12	1.76	1.94	1.71	-0.13
4	28.66	30.91	28.78	28.31	22.80	-5.86	2.27	2.55	2.43	2.45	2.22	-1.12
5	55.83	41.31	39.30	32.23	22.19	-33.64	4.40	3.33	3.27	2.79	2.14	-5.21
Amihud_Me	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	-25.57	-9.92	-5.74	-2.58	2.65	28.22	-6.93	-2.66	-1.76	-0.91	1.72	8.34
2	-21.02	-11.22	-6.18	-3.85	1.19	22.22	-5.51	-4.06	-2.08	-1.42	0.38	5.71
3	-13.55	-1.90	-5.31	-2.56	-1.31	12.24	-3.83	-0.66	-2.35	-0.93	-0.44	3.30
4	-3.21	1.57	1.15	2.66	1.36	4.57	-0.86	0.67	0.55	1.05	0.47	1.08
5	22.93	10.93	10.71	5.85	2.15	-20.79	4.18	4.18	4.69	2.36	0.70	-3.38

Note: Amihud_Me means to group by Amihud index and display them in different rows, and then group by Me and display them in different columns. Lines 1-5 represent the 5 combinations from low to high by the Amihud indicator, respectively, and R1-R5 represent the 5 combinations from low to high by Me in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

Table 22 reports the results of this paper's analysis of bivariate rankings using the Amihud indicator and float market capitalization. The empirical results are consistent with the theoretical analysis. Among the portfolios with the lowest Amihud, the portfolio with the smallest floating market cap has an annualized return of -2.9%, while the portfolio with the largest floating market cap has a return of 7.9%, a difference of nearly 11 percentage points. In the group with the highest Amihud, the situation is just the opposite. The portfolio with the smallest liquid market value has an annualized return of 55.8%, which is 33.6% higher than that of the portfolio with the largest liquid market value (significant at the 1% level).

This phenomenon is even more pronounced after adjusting for returns using the FF5 factor model. In the low-Amihud portfolio, the portfolio with the largest floating market capitalization has a 28.2% higher return than the portfolio with the smallest floating market value, with a t-value of 8.34. In addition, in the high Amihud portfolio, the return rate of the portfolio with large circulating market value is nearly 21 percentage points lower than that of the small circulating market value, and it is significant at the 1% level.

The above findings are completely consistent with the inferences in this paper. The results of the analysis are very clear: the return of the low Amihud portfolio is mainly affected by "mispricing," while the return of the high Amihud portfolio is mainly determined by "illiquidity compensation."

Then, this paper also analyzes the relationship between stock expected return and risk level in low-Amihud portfolio and high-Amihud portfolio, to further confirm the decision mechanism of low-Amihud portfolio and high-Amihud portfolio return. Under the "mispricing" mechanism, high risk is a manifestation of a high level of speculation, and the greater the risk, the lower the expected return should be. Under the mechanism of "illiquidity compensation," investors will demand higher returns as compensation for the unfavorable attributes of stocks, so stocks with high risk are expected to have higher returns. According to the above analysis, this paper draws the inference: in the low Amihud portfolio, the stock expected return decreases with the increase of the risk level; in the high Amihud portfolio, the stock expected return increases with the increase in the risk level.

This paper uses two indicators on the risk level of stocks: one is the Beta value of the capital asset pricing model (CAPM), which is used to measure the systematic risk of stocks; systemic risk. Then, this paper performs Amihud-Beta and Amihud-CAPM residual volatility bivariate ordination analysis on returns, respectively. The results are shown in Table 23 and Table 24,

respectively.

As can be seen from Table 23, in the portfolio with the lowest Amihud, the stock return decreases with the increase of systematic risk, and in the portfolio with the highest systematic risk, the average return is negative. In addition, the overall rate of return of the high Amihud portfolio is much higher than that of the low Amihud portfolio, and the return increases with the increase of systematic risk. In the portfolio with the highest systematic risk, the annualized rate of return reaches 44.9%.

Table 23: Amihud Metrics and Beta Bivariate Ranking Analysis

Amihud_Beta	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	9.46	9.39	8.20	5.28	-0.33	-9.79	1.07	0.89	0.74	0.46	-0.03	-1.68
2	16.84	16.28	16.70	13.19	7.20	-9.63	1.67	1.48	1.47	1.12	0.61	-2.34
3	20.36	21.95	21.21	23.50	15.27	-5.10	1.94	1.93	1.85	1.99	1.27	-1.33
4	25.91	30.29	30.05	28.39	24.81	-1.09	2.35	2.66	2.57	2.39	2.02	-0.26
5	31.83	37.54	37.66	38.12	45.87	14.04	2.72	3.27	3.22	3.20	3.74	2.31
Amihud_Beta	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	-4.84	-6.28	-7.79	-9.32	-13.12	-8.28	-1.56	-2.04	-2.36	-2.58	-3.06	-1.49
2	-4.01	-6.08	-6.03	-9.10	-15.98	-11.97	-1.27	-2.22	-2.09	-2.90	-4.14	-2.96
3	-2.88	-3.75	-4.83	-1.42	-11.82	-8.94	-0.92	-1.49	-1.98	-0.49	-3.23	-2.50
4	0.32	3.98	3.19	0.32	-4.31	-4.63	0.13	1.75	1.40	0.13	-1.06	-1.10
5	6.97	11.30	9.92	10.45	14.01	7.05	2.16	4.86	4.27	3.68	2.61	1.18

Note: Amihud_Beta means first grouped by Amihud indicator and displayed in different rows, and then grouped by Beta and displayed in different columns. Lines 1-5 represent the 5 combinations from low to high by the Amihud indicator, and R1-R5 represent the 5 combinations from low to high by Beta in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

After the returns are adjusted by the FF5 factor model, the above phenomenon still exists. In the low Amihud portfolio, the higher the systematic risk level, the lower the portfolio return; in the high Amihud portfolio, the higher the systematic risk level, the higher the portfolio return.

On the other hand, Table 24 reports the results of a bivariate ordination analysis of Amihud and CAPM residual volatility on returns. In low Amihud portfolios, yields tend to be lower as the level of unsystematic risk rises. In high Amihud portfolios, returns are additionally compensated by rising levels of unsystematic risk. From the portfolio with the lowest level of unsystematic risk to the portfolio with the highest, the average portfolio returns gradually increased from 31.9% to

45.1%.

In addition, after risk-adjusting returns using the FF5 factor model, the results remain the same. In the low Amihud portfolio, the greater the unsystematic risk, the lower the return; in the high Amihud portfolio, the greater the unsystematic risk, the higher the return.

The above empirical results are completely consistent with the inferences in this paper. This further reinforces the paper's conclusion that the dominant mechanism of returns in low Amihud portfolios is "mispricing," while in high Amihud portfolios it is "illiquidity compensation."

Table 24: Bivariate ranking analysis of Amihud indicators and unsystematic risk

Amihud_Nonsysrisk	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	9.09	10.29	8.28	5.28	-0.93	-10.02	1.00	0.98	0.75	0.45	-0.08	-1.75
2	17.88	16.66	16.39	12.80	6.48	-11.40	1.76	1.50	1.42	1.11	0.55	-2.66
3	20.46	21.45	22.77	22.34	15.28	-5.19	1.92	1.90	1.95	1.93	1.27	-1.40
4	26.24	30.98	27.96	29.40	24.87	-1.37	2.37	2.71	2.42	2.47	2.02	-0.33
5	31.87	37.09	37.65	38.79	45.62	13.75	2.74	3.21	3.21	3.28	3.71	2.33
Amihud_Nonsysrisk	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	-5.63	-5.13	-8.09	-8.73	-13.76	-8.14	-1.75	-1.72	-2.48	-2.33	-3.20	-1.45
2	-3.69	-6.09	-5.80	-9.03	-16.60	-12.91	-1.16	-2.18	-1.98	-2.97	-4.20	-2.98
3	-3.42	-3.39	-4.21	-1.64	-12.03	-8.61	-1.10	-1.24	-1.75	-0.54	-3.36	-2.42
4	0.36	4.77	1.31	1.23	-4.15	-4.51	0.14	2.03	0.60	0.48	-1.05	-1.10
5	6.97	10.55	10.29	10.33	14.51	7.53	2.18	4.70	4.33	3.41	2.70	1.28

Note: Amihud_Nonsysrisk means to first group by Amihud indicators and display them in different rows, and then group them by Nonsysrisk and display them in different columns. Lines 1-5 represent the 5 combinations from low to high by Amihud indicators, and R1-R5 represent the 5 combinations from low to high by Nonsysrisk in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

Although this paper has provided very detailed evidence that the high returns of high Amihud portfolios originate from "illiquidity compensation," there are still other possible theories that challenge the interpretation of "illiquidity compensation." One theory is that high Amihud portfolios earn high returns because the stock price recovers to a reasonable level after a panic decline (hereafter referred to as "panic repair"). Noting that stocks with high Amihud portfolios experienced rapid declines in share price and turnover before achieving excess returns, the explanation for "panic repair" has some plausibility. Moreover, stocks with inactive trading, small circulating market capitalization, and high risk levels are more prone to panic, and there will be

more stock price repairs later, so the expected return on stocks is also higher. Therefore, "panic repair" can also explain the empirical results of the high Amihud combination earlier in this paper.

In order to distinguish between "panic repair" and "illiquidity compensation," this paper analyzes the different "symptoms" of the two mechanisms. If the yield of the high Amihud portfolio is mainly determined by "panic repair," stocks with high valuations will be more prone to panic due to the lack of fundamental support, so the return from future stock price repairs will be higher. On the other hand, if the dominant mechanism of high Amihud portfolio returns is "illiquidity compensation," then investors should be more rational, so they will demand corresponding compensation for various risk factors in the portfolio. As predicted by the Fama-French three-factor model, value stocks (stocks with higher book-to-market value) should yield higher returns than growth stocks because of their greater exposure to the risk factor HML. In general, if the decision mechanism of high Amihud portfolio returns is "panic repair," then the expected return is positively related to the stock valuation level; if it is "illiquidity compensation," the expected return is negatively related to the valuation level.

Table 25: Bivariate ranking analysis of Amihud indicator and book-to-market ratio

Amihud_Bm	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	1.64	2.57	5.65	11.04	11.19	9.55	0.15	0.24	0.51	1.01	1.07	1.44
2	10.86	11.49	15.93	17.26	14.72	3.87	0.98	1.00	1.41	1.50	1.32	0.71
3	17.40	20.69	20.67	23.94	19.63	2.22	1.56	1.79	1.79	2.04	1.72	0.47
4	22.07	28.97	29.96	29.10	29.41	7.34	1.91	2.51	2.56	2.48	2.53	1.87
5	31.11	34.71	39.21	40.32	45.82	14.71	2.65	2.97	3.28	3.48	3.92	3.27
Amihud_Bm	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	-13.33	-12.38	-10.43	-3.66	-1.49	11.83	-3.51	-3.71	-3.30	-1.23	-0.53	2.70
2	-11.14	-11.58	-6.12	-5.64	-6.68	4.46	-3.07	-3.51	-2.32	-1.76	-2.14	1.03
3	-6.89	-5.59	-4.92	-1.52	-5.75	1.14	-1.97	-1.95	-1.82	-0.52	-2.02	0.30
4	-3.80	2.27	1.87	1.69	1.53	5.33	-1.42	0.89	0.77	0.74	0.50	1.65
5	4.21	6.98	10.50	11.98	19.13	14.92	1.53	2.58	3.95	4.96	4.17	3.31

Note: Amihud_Bm means to first group by Amihud index and display them in different rows, and then group by Bm and display them in different columns. Lines 1-5 represent the 5 combinations from low to high according to the Amihud index, and R1-R5 represent the 5 combinations from low to high by Bm in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

The bivariate ranking analysis results of Amihud and book-to-market ratio are shown in Table

25. In high Amihud portfolios, stock returns increase as book-to-market ratios increase. The higher the book-to-market ratio, the lower the stock valuation level. Therefore, this result supports that the dominant mechanism for high Amihud portfolio returns is "illiquidity compensation" rather than "panic repair."

In addition, this paper also uses the ratio of earnings per share to stock price and the dividend rate to measure the stock valuation level. The higher the ratio of EPS to stock price, the lower the stock valuation, and the dividend rate is also the same. The results of the bivariate ranking analysis are shown in Table 26 and Table 27, respectively. The main conclusions are the same as the original: in the portfolio with the highest Amihud, the lower the valuation level, the higher the expected return.

Table 26: Bivariate ranking analysis of Amihud indicator and profit-to-market ratio

Amihud_Epstop	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	-1.23	3.54	5.91	12.06	11.71	12.95	-0.10	0.33	0.58	1.14	1.09	2.31
2	8.70	13.72	13.86	16.52	17.43	8.73	0.73	1.17	1.27	1.58	1.57	2.45
3	18.62	21.65	20.47	22.02	19.52	0.90	1.55	1.81	1.83	2.01	1.76	0.26
4	29.60	28.75	25.93	27.73	27.39	-2.21	2.36	2.39	2.26	2.51	2.47	-0.58
5	36.78	34.72	36.05	36.36	47.09	10.31	3.03	2.89	2.99	3.19	4.10	1.73
Amihud_Epstop	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	-19.95	-13.01	-8.06	-0.76	0.41	20.36	-5.49	-3.88	-2.73	-0.26	0.14	5.37
2	-16.04	-9.67	-8.55	-3.62	-3.28	12.76	-5.88	-3.10	-2.80	-1.24	-0.96	4.05
3	-7.54	-5.34	-4.66	-3.20	-3.95	3.59	-2.99	-1.89	-1.57	-1.06	-1.27	1.21
4	2.03	0.03	-1.71	2.41	0.68	-1.35	0.80	0.01	-0.67	0.94	0.21	-0.41
5	10.75	7.62	6.41	8.14	19.69	8.94	3.32	2.94	2.32	2.86	3.91	1.52

Note: Amihud_Epstop means to first group by Amihud indicators and display them in different rows, and then group them by Epstop and display them in different columns. Lines 1-5 represent the 5 combinations from low to high by the Amihud indicator, and R1-R5 represent the 5 combinations from low to high by Epstop in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

In addition, combined with the results of previous event studies on high-Amihud portfolios, high-Amihud portfolios can consistently achieve higher excess returns within 30 months, while "panic repair" should be completed in a shorter period of time. On the other hand, panic should only occur among some investors, and arbitrage transactions by other rational investors will make excess returns disappear, so the explanation of "illiquidity compensation" is more reasonable. Based on the above analysis, this paper excludes the "panic repair theory" about the return of high

Amihud portfolio.

3.2.10 Amihud premium in time series

Amihud (2002) [3] found that the Amihud indicator could not only explain the stock cross-sectional return differences, but also predict the time series changes of market returns. The detailed process is: first average all stock Amihud indicators in each period to obtain the time series of the market average Amihud indicators, then perform a first-order autoregression on it, define the fitted value as the expected market illiquidity, and define the residual error as the expected market illiquidity. Defined as unexpected market illiquidity, it is found that market returns are positively correlated with expected illiquidity and negatively correlated with unexpected illiquidity.

In this paper, Amihud (2002) [3] re-analyzes the time series analysis using the data of the A-share market. Since the analysis of the "Amihud premium" on the time series only needs to use the rate of return and the Amihud indicator, and the data availability is strong, the research period selected in this paper is from December 1990 to March 2018, a total of 328 months. December 1990 was the period when A-shares started trading. Since the estimation of expected illiquidity requires the use of a lagged term, a total of 327 samples were included in the regression analysis. Due to a small amount of missing data, the sample size of some models is 326. The results are summarized in Table 28. The explained variable of model (1) is the market risk premium, which is obtained by subtracting the monthly risk-free interest rate from the market capitalization-weighted return. The explained variables of models (2)-(11) are the market capitalization from low to high, respectively. The excess return of the ten portfolios grouped is obtained by subtracting the monthly risk-free rate from the monthly average return of the portfolio.

The empirical results of the A-share market are very similar to Amihud (2002) [3]. The coefficient of expected illiquidity is significantly positive at the 5% level, and the coefficient of unexpected illiquidity is significantly negative at the 1% level. Moreover, the relationship between expected illiquidity and market returns weakens as the market capitalization increases. In the portfolio with the largest floating market capitalization, the impact of expected illiquidity on market returns is no longer significant.

However, this paper questions the soundness of Amihud's (2002) [3] analysis method. In estimating expected illiquidity, Amihud (2002) [3] used a sample of the entire study period. In fact, in each period, investors can only predict the illiquidity of the next period based on past information. Therefore, the analysis of Amihud (2002) [3] may have a problem of "hindsight," and

expected illiquidity may contain information about future returns, which can cause endogeneity problems and lead to biased coefficient estimates.

Therefore, in order to solve the problem of "hindsight," this paper uses the sample of the past 60 months to perform a first-order autoregression, and then obtains the expected and unexpected illiquidity of each month, which can avoid using information of future time when estimating the parameters. This paper finds that the expected illiquidity obtained by the above method no longer predict the market return, while the unexpected illiquidity is still negatively correlated with the market return in the same period.

Table 27: Bivariate ranking analysis of Amihud index and dividend yield

Amihud_Dividend	R1	R2	R3	R4	R5	Dif	T1	T2	T3	T4	T5	T_Dif
1	4.03	5.68	11.37	11.09	-0.08	-4.11	0.36	0.53	1.09	1.04	-0.01	-1.31
2	15.35	16.51	15.62	11.65	11.12	-4.23	1.35	1.51	1.45	1.06	0.95	-1.80
3	22.70	21.63	22.84	18.73	16.36	-6.34	1.91	1.94	2.08	1.66	1.40	-2.87
4	29.60	28.59	27.22	27.22	26.80	-2.80	2.50	2.54	2.41	2.28	2.31	-1.17
5	35.27	35.96	35.72	41.35	42.73	7.46	3.00	3.10	3.10	3.52	3.64	2.25
Amihud_Dividend	A1	A2	A3	A4	A5	Dif_A	T_A1	T_A2	T_A3	T_A4	T_A5	T_Dif_A
1	-12.87	-9.10	-1.18	-2.10	-15.99	-3.12	-3.77	-2.98	-0.40	-0.71	-5.35	-1.07
2	-7.23	-4.81	-4.39	-11.51	-13.20	-5.98	-2.61	-1.63	-1.48	-3.75	-4.44	-2.48
3	-3.17	-3.19	-0.92	-6.06	-11.34	-8.17	-1.17	-1.09	-0.36	-2.06	-4.23	-3.66
4	1.10	2.34	2.85	-1.57	-1.20	-2.29	0.47	0.96	1.03	-0.65	-0.47	-0.87
5	7.21	8.27	8.09	15.50	13.60	6.39	2.95	3.34	2.96	4.36	4.12	1.85

Note: Amihud_Dividend means to first group by Amihud index and display them in different rows, and then group by Dividend and display them in different columns. Lines 1-5 represent the 5 combinations divided by the Amihud index from low to high, and R1-R5 represent the 5 combinations divided by the Dividend from low to high in each row. The numbers in the corresponding columns of R1-R5 in the table are the annualized rate of return (%), which is obtained by multiplying the monthly rate of return by 12. Dif represents the difference between the returns of the 5th combination and the 1st combination in each row. T1, T2, ⋯, T5 and T_Dif correspond to the t statistics of R1, R2, ⋯, R5 and Dif, respectively, using ordinary Standard errors are calculated. Similarly, the lower part of the table reports the FF5 factor-adjusted portfolio returns and the corresponding t-statistics.

In addition, this paper also considers the autoregressive model with two or three lag lags, and the conclusions are also consistent with the original. Based on the above results, this paper believes that there is no "Amihud premium" in the A-share market in time series.

Table 28: "Amihud Premium" on Time Series

	Risk Premium	Small Cap	2	3	4	5	6	7	8	9	Large Cap
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Full Sample											
Expected Illiquidity	0.00789**	0.0356***	0.00878*	0.0456***	0.0213***	0.00750*	0.0211***	0.0224***	0.00480	0.00761*	0.00103
	(0.00367)	(0.00819)	(0.00455)	(0.00926)	(0.00563)	(0.00448)	(0.00583)	(0.00560)	(0.00384)	(0.00454)	(0.00335)
Unexpected Illiquidity	-0.0392***	-0.0283	-0.0400***	-0.0245	-0.0351***	-0.0508***	-0.0323**	-0.0395***	-0.0290***	-0.0235**	-0.0496***
	(0.00876)	(0.0196)	(0.0109)	(0.0209)	(0.0134)	(0.0101)	(0.0139)	(0.0126)	(0.00917)	(0.0102)	(0.00801)
Constant	0.167**	0.749***	0.199**	0.937***	0.448***	0.164*	0.441***	0.460***	0.107	0.162*	0.0266
	(0.0723)	(0.162)	(0.0896)	(0.183)	(0.111)	(0.0884)	(0.115)	(0.111)	(0.0758)	(0.0896)	(0.0661)
Obs	327	327	327	326	327	326	327	326	327	326	327
R-squared	0.071	0.061	0.051	0.071	0.061	0.077	0.054	0.068	0.034	0.023	0.106
Rolling 60-month											
Expected Illiquidity	-0.00293	-0.0133**	-0.00935*	-0.00928*	-0.00664	-0.00626	-0.00574	-0.00520	-0.00464	-0.00363	-0.00315
	(0.00391)	(0.00586)	(0.00496)	(0.00480)	(0.00480)	(0.00469)	(0.00464)	(0.00446)	(0.00440)	(0.00431)	(0.00432)
Unexpected Illiquidity	-0.0797***	-0.0973***	-0.110***	-0.105***	-0.107***	-0.103***	-0.0979***	-0.0989***	-0.0953***	-0.0922***	-0.0807***
	(0.00931)	(0.0140)	(0.0118)	(0.0114)	(0.0114)	(0.0112)	(0.0111)	(0.0106)	(0.0105)	(0.0103)	(0.0103)
Constant	-0.0554	-0.244**	-0.175*	-0.177*	-0.124	-0.120	-0.110	-0.100	-0.0897	-0.0698	-0.0602
	(0.0789)	(0.118)	(0.100)	(0.0968)	(0.0967)	(0.0945)	(0.0936)	(0.0900)	(0.0888)	(0.0869)	(0.0872)
Obs	278	278	278	278	278	278	278	278	278	278	278
R-squared	0.211	0.154	0.239	0.237	0.243	0.236	0.222	0.240	0.231	0.227	0.183

Note: Common standard errors are reported in parentheses, and ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively. The dependent variable of the regression is the monthly excess return of each portfolio. Small market capitalization, 2, 3, . . ., 9 and large market capitalization are ten combinations from small to large market capitalization.

4. The Analyses of Daily Amihud Premium: A New Micro-Horizon

4.1 The significance of studying daily Amihud premium

In the previous analysis, this article used monthly data and examined the "Amihud premium" with a relatively large time span. So, do stocks with higher Amihud metrics also enjoy higher returns over shorter periods of time, like between each trading day? To answer this question, this paper also studies the relationship between the daily Amihud indicator and daily stock cross-sectional returns. It is worth mentioning that daily data analysis is not only a robustness test for monthly data analysis, but also a new exploration of the short-term behavior of stock returns. Because the determinants of daily stock returns are quite different from monthly returns, the story of the daily "Amihud Premium" may also be different from the monthly "Amihud Premium." In addition, research on daily stock returns can help market participants and regulators better understand the factors that affect short-term stock returns, thereby deepening the understanding of investor behavior and market microstructure, and helping investors realize rational investment decisions, It is of great significance for policy makers to conduct timely and effective market supervision.

4.2 Sample selection and descriptive statistics

4.2.1 Sample selection

As with the monthly analysis, this article selects a sample of transaction dates between January 1, 2007 and March 31, 2018. In addition, this paper excludes observations with a yield greater than 9.5% or less than -9.5% at the close of the previous trading day, because these samples are at or near the limit, and stocks cannot be freely traded at the market price at that time. Chen et al (2019) [65] discussed the stock price behavior when the stock price was in the limit-up-down state at the close of the previous trading day. This article does not consider stocks in abnormal trading status such as ST, *ST, **ST or PT. In addition, this article also excludes samples with a daily return rate greater than 10.5% or less than -10.5%, because this exceeds the limit of a single trading day's rise or fall of no more than 10% during normal stock trading. Occurs under special circumstances such as a trading day. In addition, referring to the practice of Fama and French (1992) [56], this paper excludes samples with negative book-to-market ratios.

4.2.2 Descriptive statistics

Table 29 reports the descriptive statistical results of the main variables used in the study of the daily “Amihud premium” of the A-share market in this paper. The average daily stock return is

0.065%, while the standard deviation is over 3%. The average risk-free interest rate (measured by the daily one-year fixed deposit rate) is 0.7/10,000, which is about one-tenth of the average daily stock return rate. The average value of the circulating market value is 9.8 billion yuan, the smallest is less than 80 million yuan, and the largest is close to 2.4 trillion yuan. The average return in the last trading day was 0.047%, while the average cumulative return over the past two to five trading days reached 0.356%. The book-to-market ratio of a typical sample is 0.365, the daily turnover rate is close to 3%, the transaction volume is around 150 million, and the relative spread is 0.15%. These values are relatively close to the corresponding monthly data.

Amihud is the variable analyzed in this paper. This paper examines Amihud metrics with frequencies ranging from 1 minute, 5 minutes to daily. The descriptive statistics table reports the logarithm of the Amihud metric. A very clear trend is that the mean of the Amihud metric keeps getting larger as the frequency of calculation increases. In addition, the variation range of Amihud is very large. Taking the frequency of 5 minutes as an example, the minimum value is -30.8, and the maximum value is -10.5. When the logarithmic index increases by 1, the original index increases by 1.7 times, which shows that the Amihud index is characterized by the illiquidity of stocks varies greatly from stock to stock and from period to period.

Table 29: Descriptive Statistics of Main Variables for Daily Data

Variable	Abbreviation	Obs	Mean	Std	Min	Max
Daily Return	R	5,353,873	0.065	3.090	-10.40	10.47
Daily Risk-free Interest Rate	Rf	5,353,873	0.007	0.002	0.004	0.011
Circulating Market Cap (Million Yuan)	Me	5,353,873	9794	45795	79.68	2372158
Book to Market Ratio	Bm	5,193,960	0.365	0.255	0.000	4.936
Return in day -1	R1lag	5,353,873	0.047	2.728	-9.500	9.500
Return from day -5 to -2	R5lag	5,345,356	0.356	6.476	-34.55	47.09
Turnover	Turnover	5,353,873	2.938	3.653	0.002	79.65
Trading Volume (Ten Thousand in Yuan)	Trd	5,353,873	14748	35326	5.198	6794128
Relative Bid-Ask Spread (%)	Rpd	5,326,931	0.150	0.076	0.009	5.520
Best Quote Order Depth (Ten Thousand Yuan)	Depth1	5,326,931	28.03	187.3	0.025	161248
Best Five Quote Order Depth (Ten Thousand Yuan)	Depth2	5,326,931	184.7	714.8	0.109	299438
Amihud Indicator of 1-min Frequency	Amihud01m	5,345,208	-18.80	1.181	-32.30	-11.15
Amihud Indicator of 5-min Frequency	Amihud05m	5,345,574	-19.79	1.345	-30.77	-10.53
Amihud Indicator of 10-min Frequency	Amihud10m	5,345,324	-20.31	1.320	-30.54	-10.13
Amihud Indicator of 15-min Frequency	Amihud15m	5,345,212	-20.60	1.301	-30.54	-13.12
Amihud Indicator of 30-min Frequency	Amihud30m	5,344,918	-21.10	1.280	-30.76	-12.67
Amihud Indicator of 60-min Frequency	Amihud60m	5,343,828	-21.61	1.297	-30.40	-12.09
Amihud Indicator of daily Frequency	Amihud_daily	5,227,756	-22.27	1.492	-31.90	-13.16

4.3 Empirical results

4.3.1 Daily Fama-MacBeth regressions

This paper uses the Fama-MacBeth two-step approach to study the determinants of cross-sectional differences in daily stock returns. On each trading day, cross-sectional regression of the excess returns of stocks on various stock characteristics was performed, and then the average of the coefficient estimates for all trading days was taken. Considering that the estimated value of the coefficient is a time series, there may be autocorrelation, this paper uses the Newey-West heteroskedastic autocorrelation robust standard error [58] to adjust the t value of the coefficient estimate, referring to Amihud and Noh (2018) [2] In practice, the lag order selected in this paper is 6.

In the daily Fama-MacBeth regression, the benchmark model set in this paper is as follows:

$$\left(R_j - r_f\right)_t = c0_t + c1_t * Amihud_{j,t-1} + c2_t * Me_{j,t-1} + c3_t * Bm_{j,t-1}$$
$$+c4_t * R1lag_{j,t-1} + c5_t * R5lag_{j,t-2} + error_{j,t},$$

$\left(R_j - r_f\right)_t$ is the excess rate of return of stock j on the t-th trading day. The specific calculation method is to subtract the risk-free interest rate of the day from the rate of return considering the reinvestment of dividends (daily one-year fixed deposit interest rate). $Amihud_{j,t-1}$ is the Amihud index of stock j on the t-1th trading day. In order to reduce the influence of extreme values, this paper uses the logarithmic Amihud index. In addition, in the daily data analysis, this paper considers the impact of the following control variables on the expected stock return: (1) $Me_{j,t-1}$ is the circulating market value of stock j on t-1 trading day (2) $Bm_{j,t-1}$ is the logarithm of the book-to-market ratio of stock j on the t-1th trading day; (3) $R1lag_{j,t-1}$ is the return of stock j on the t-1th trading day, which is used to capture the "reversal effect" of the daily stock return; (4) $R5lag_{j,t-2}$ is the return of stock j from the tth The cumulative return from t-5th trading day to the t-2th trading day for 4 trading days is used to describe the "momentum effect" that may exist in the daily stock return.

Table 30: Daily Fama-MacBeth regression results

	Only Controls	Only Trd	Only Turnover	Only Amihud_daily	Trd	Turnover	Amihud_daily
Dep: R-rf	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Me	-0.000351***				0.000425***	-0.000753***	-6.82e-05
	(-4.706)				(4.170)	(-9.574)	(-0.818)
Bm	0.000385***				0.000174**	0.000174**	0.000292***
	(4.394)				(2.080)	(2.080)	(3.405)
R1lag	-0.00543**				0.000681	0.000681	-0.0104***
	(-2.004)				(0.255)	(0.255)	(-3.932)
R5lag	-0.0243***				-0.0199***	-0.0199***	-0.0233***
	(-22.66)				(-18.69)	(-18.69)	(-21.96)
Trd		-0.00115***			-0.00118***		
		(-15.27)			(-13.23)		
Turnover			-0.000904***			-0.00118***	
			(-9.563)			(-13.23)	
Amihud_daily				0.000574***			0.000410***
				(11.24)			(8.962)
Constant	0.00669***	0.0219***	0.00374***	0.0137***	0.0160***	0.0160***	0.0115***
	(4.814)	(13.99)	(8.501)	(10.56)	(10.76)	(10.76)	(8.184)
Obs	5,187,258	5,353,872	5,353,872	5,226,331	5,187,258	5,187,258	5,061,503
R-squared	0.060	0.015	0.023	0.011	0.072	0.072	0.066
Groups	2,730	2,734	2,734	2,734	2,730	2,730	2,730

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively.

Table 30 reports the results of Fama-MacBeth regression of daily stock returns on individual stock characteristics. The daily Fama-MacBeth regression requires a large amount of computation. Each column in the table corresponds to the average value of nearly 3000 sub-regression coefficients. Therefore, this paper uses parallel computing technology to improve the speed of data processing.

Model (1) only added control variables, in which the coefficient of circulating market value is negative, and it is significant at the level of 1%, indicating that there is an obvious "small market value premium" in the A-share market during the sample period; The 1% level is significantly positive, indicating that the average performance of value stocks is better than that of growth stocks; in addition, after excluding the samples that were at the limit of up and down at the close of the previous trading day, the rate of return for one trading day lag and the current rate of return There is a negative correlation (significant at the 5% level), indicating that the daily return of the A-share market has an obvious "reversal effect" in the cross section; the coefficient of the cumulative return in the past two to five trading days is at the 1% level is significantly negative, and the t-statistic is as high as 22.7, indicating a strong inverse relationship between stock returns and returns over the past week.

Models (2)-(4) examine the results of the regression of the return on the trading volume, turnover rate and daily Amihud index respectively, and the daily return rate is significantly negative with the trading volume or turnover rate of the previous trading day. correlation, while the coefficient of the Amihud indicator is significantly positive at the 1% level. The sign and significance of transaction volume, turnover, and Amihud remain unchanged after adding control variables.

In model (5), after adding the transaction amount, the sign of the circulating market value changes from negative to positive. In addition, the coefficient of the rate of return after one trading day becomes insignificant, which shows that the transaction amount simultaneously depicts the "small market value effect" and "Reversal Effect." In model (6), since the circulating market value is controlled, and the turnover rate is the ratio of the transaction amount to the circulating market value, the magnitude and significance of the turnover rate coefficient are exactly the same as the transaction amount in model (5). In model (7), when Amihud is added to the regression equation, the coefficient of circulating market value becomes insignificant, indicating that Amihud absorbs the "small market value effect," while the coefficient of R1lag is significantly more significant, indicating that after controlling the influence of Amihud, the "reversal effect" of daily stock returns will be stronger.

4.3.2 The priced component of Amihud Measure

Then, this paper uses daily data to continue to explore the controversial issue in Lou and Shu (2017) [1] and Amihud and Noh (2018) [2]: Is the Amihud indicator priced as a component of transaction volume? To this end, this article puts the Amihud indicator in a “horse race” against trading volume, turnover, and high-frequency liquidity indicators.

Table 31 presents the “horse race” results for the Amihud metric versus other liquidity metrics. After adding transaction volume or turnover rate to the model, Amihud's coefficient becomes insignificant, which indicates that the explanatory power of Amihud indicator for daily expected returns can be completely explained by transaction volume or turnover rate.

Table 31: Daily “horse race” results for Amihud Metrics vs. Other Liquidity Metrics

	Trd	Turnover	Rpd	Depth1	Depth2
Dep: R-rf	(1)	(2)	(3)	(4)	(5)
Amihud_daily	7.85e-05	7.85e-05	0.000281***	0.000239***	0.000284***
	(1.514)	(1.514)	(6.275)	(5.209)	(6.088)
Trd	-0.00108***				
	(-10.88)				
Turnover		-0.00108***			
		(-10.88)			
Rpd			0.00126***		
			(9.185)		
Depth1				-0.00103***	
				(-12.57)	
Depth2					-0.000716***
					(-8.395)
Controls	YES	YES	YES	YES	YES
Obs	5,061,503	5,061,503	5,045,117	5,045,117	5,045,117
R-squared	0.075	0.075	0.072	0.070	0.071
Groups	2,730	2,730	2,730	2,730	2,730

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. To save space, results for constant terms and control variables are not reported here.

In the "horse race" with relative spreads, the coefficients of both Amihud and relative spreads are significantly positive at the 1% level, which shows that the Amihud indicator cannot fully explain the predictive effect of relative spreads on daily stock returns. Similarly, in the "horse race" between Amihud and one tick depth, the coefficient of one tick depth is significantly negative at the 1% level, which indicates that the daily Amihud indicator cannot fully capture the quotation depth on the daily expected stock return rate impact. The situation of the five-level quotation depth

is similar to that of the one-level quotation depth. Overall, the Amihud indicator does not explain the impact of high-frequency liquidity indicators on expected daily stock returns, unlike the results from the monthly data.

The daily Amihud indicator (Amihud_daily) has only a single value of |R|/Volume. In contrast, the monthly Amihud indicator is the average of all trading days (about 20) |R|/Volume in the month, so the daily frequency is used The Amihud index to estimate E(|R|/Volume) has a large error. Therefore, this paper uses higher frequency data to calculate the Amihud index, hoping to estimate E(|R|/Volume) more accurately.

Table 32 shows the impact of the Amihud metric on daily expected returns for frequencies from 1 minute to 60 minutes. In the case of controlling other variables, except for the 1-minute version of Amihud, the coefficients of the Amihud indicators of each frequency are significantly positive at the 1% level, and the coefficients have increased a lot compared to Amihud_daily (from less than 0.0006 to about 0.0009), indicating that the high-frequency Amihud indicator captures the "illiquidity premium" more effectively than the daily Amihud indicator. The coefficient of Amihud01m is negative because stocks with lower Amihud01m on day t-1 still have higher average returns on day t. When this paper uses Amihud01m (L2Amihud01m) with a lag of two trading days, its regression coefficient becomes positive and significant at the 1% level.

So, after increasing the calculation frequency of the Amihud indicator, is the component priced in the Amihud indicator still only the part related to the transaction volume? To answer this question, this paper conducts a “horse race” between the Amihud indicator at various frequencies and transaction volume. The results are summarized in Table 33.

The regression results show that in the "horse race" with the transaction volume, the coefficients of the Amihud indicators for each frequency become insignificant, and even turn from positive to negative. This result shows that after excluding the components related to transaction volume in the indicator, the remaining components in the Amihud indicator have no predictive effect on the daily expected stock return, and even bring about the opposite effect of the "illiquidity premium.” This result again shows that the impact of the Amihud indicator on expected returns comes from the transaction value-related components of the indicator.

Table 32: The explanatory power of the high-frequency version of the Amihud indicator for daily stock cross-sectional returns

Dep: R-rf	Amihud01m (1)	L2Amihud01m (2)	Amihud05m (3)	Amihud10m (4)	Amihud15m (5)	Amihud30m (6)	Amihud60m (7)
Me	-0.000799***	0.000135	0.000366***	0.000387***	0.000411***	0.000401***	0.000350***
	(-8.524)	(1.632)	(3.798)	(4.064)	(4.318)	(4.337)	(3.965)
Bm	0.000439***	0.000280***	0.000297***	0.000307***	0.000312***	0.000316***	0.000316***
	(5.301)	(3.270)	(3.487)	(3.581)	(3.630)	(3.652)	(3.658)
R1lag	-0.00993***	0.00335	-0.00523**	-0.00540**	-0.00573**	-0.00642**	-0.00738***
	(-3.749)	(1.102)	(-1.988)	(-2.051)	(-2.177)	(-2.438)	(-2.805)
R5lag	-0.0266***	-0.0235***	-0.0240***	-0.0240***	-0.0239***	-0.0238***	-0.0238***
	(-24.17)	(-22.12)	(-21.83)	(-21.78)	(-21.75)	(-21.67)	(-21.61)
Amihud01m	-0.000770***						
	(-10.98)						
L2Amihud01m		0.000707***					
		(11.54)					
Amihud05m			0.000926***				
			(12.79)				
Amihud10m				0.000965***			
				(13.37)			
Amihud15m					0.00100***		
					(13.92)		
Amihud30m						0.000992***	
						(14.51)	
Amihud60m							0.000922***
							(14.74)
Obs	5,168,515	5,020,108	5,169,489	5,169,487	5,169,485	5,169,445	5,168,532
R-squared	0.068	0.070	0.070	0.069	0.069	0.069	0.068
Groups	2,730	2,729	2,730	2,730	2,730	2,730	2,730

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. To save space, constant terms are not reported here.

Table 33: Daily "horse race" results for Amihud metrics by transaction volume and frequency

Dep: R-rf	Amihud01m (1)	L2Amihud01m (2)	Amihud05m (3)	Amihud10m (4)	Amihud15m (5)	Amihud30m (6)	Amihud60m (7)
Me	-1.13e-05	0.000386***	0.000337***	0.000341***	0.000356***	0.000388***	0.000420***
	(-0.116)	(4.121)	(3.442)	(3.496)	(3.654)	(4.013)	(4.364)
Bm	0.000359***	0.000223***	0.000136*	0.000135*	0.000145*	0.000160*	0.000175**
	(4.482)	(2.697)	(1.664)	(1.656)	(1.772)	(1.944)	(2.133)
R1lag	0.00716***	0.0107***	0.00134	0.00128	0.000931	0.000243	-0.00110
	(2.743)	(3.571)	(0.511)	(0.487)	(0.352)	(0.0912)	(-0.409)
R5lag	-0.0155***	-0.0207***	-0.0196***	-0.0198***	-0.0199***	-0.0204***	-0.0206***
	(-15.08)	(-19.65)	(-18.97)	(-19.10)	(-19.16)	(-19.51)	(-19.69)
Trd	-0.00417***	-0.00124***	-0.00154***	-0.00148***	-0.00134***	-0.00122***	-0.00108***
	(-24.99)	(-11.98)	(-11.50)	(-11.11)	(-10.16)	(-9.770)	(-9.451)
Amihud01m	-0.00379***						
	(-28.33)						
L2Amihud01m		-0.000169**					
		(-2.516)					
Amihud05m			-0.000460***				
			(-4.774)				
Amihud10m				-0.000394***			
				(-4.097)			
Amihud15m					-0.000245***		
					(-2.598)		
Amihud30m						-9.45e-05	
						(-1.148)	
Amihud60m							8.69e-05
							(1.258)
Obs	5,184,105	5,020,108	5,185,072	5,185,071	5,185,071	5,185,031	5,184,116
R-squared	0.081	0.078	0.076	0.076	0.076	0.076	0.075
Groups	2,730	2,729	2,730	2,730	2,730	2,730	2,730

Note: In parentheses are the t values calculated using the Newey-West (1987) robust standard error of heteroskedastic autocorrelation with lag 6, ***, **, * represent the significance levels of 1%, 5% and 10%, respectively. To save space, constant terms are not reported here.

4.3.3 Cumulative returns of holding the high-Amihud-portfolio and low-Amihud-portfolio in the last trading day

This paper not only pays attention to the coefficient of Amihud index in the regression model, but also examines the return rate of each portfolio with different Amihud levels. In this section, the frequency of calculating the Amihud indicator in this paper is 5 minutes, because the estimation error of using daily data will be relatively large, and the frequency is too high, and it is easily affected by the noise of market microstructure.

The construction method of the portfolio in this paper is as follows: on the t-th trading day, according to the Amihud index of the t-1th trading day, sort from low to high, then divide the stocks into 10 portfolios equally, and then take these 10 portfolios respectively The average percentage return of all stocks in the t-th trading day is converted into a logarithmic return, and then accumulated, and finally the cumulative return is obtained.

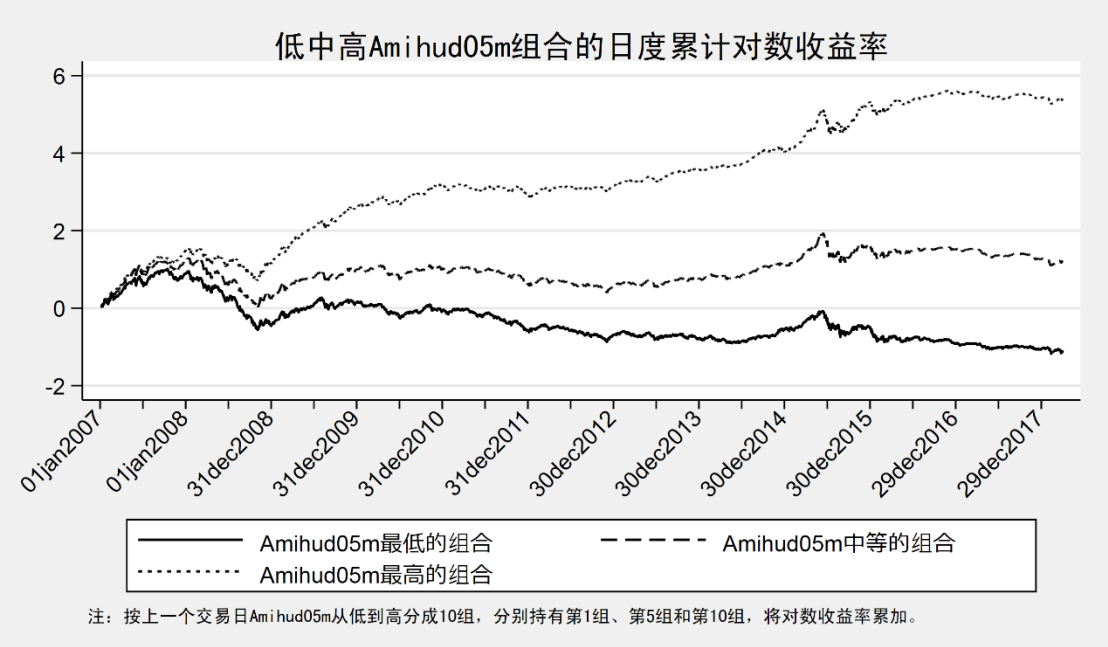

Figure 9: Cumulative returns of holding low, medium and high portfolios sorted by Amihud05m from the previous trading day

This article focuses on the cumulative return trend of the portfolio with the lowest Amihud (Group 1), the portfolio with medium Amihud (Group 5), and the portfolio with the highest Amihud (Group 10). The results are shown in Figure 9. Throughout the sample period, the

cumulative returns of these three portfolios showed a certain synchronicity, such as rising at the same time in the bull market in 2007, falling together during the global financial crisis in 2008, and experiencing a rapid rise and fall in stock prices in 2015. Wait. However, the cumulative yield gap of the three portfolios shows an expanding trend, among which the portfolio with the highest Amihud has a strong upward trend, the portfolio with the lowest Amihud has a continuous decline in cumulative yield, and the cumulative yield curve of the portfolio with a moderate Amihud level is between the previous two.

In addition, in order to eliminate the heterogeneity of individual stock returns and the impact of various risk factors on the expected daily stock returns, this paper subtracts the part predicted by the FF5 factor model from the daily returns of all stocks, and then recalculates each The cumulative return of the portfolio, the results obtained are shown in Figure 10.

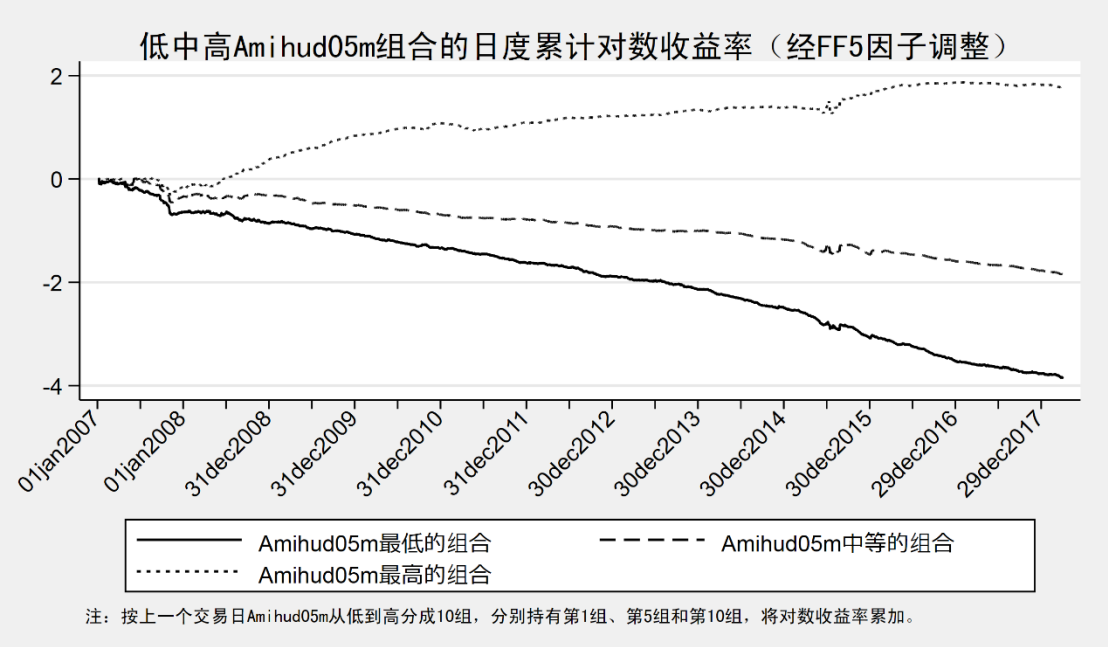

Figure 10: Cumulative yield of holding a portfolio of low, medium and high Amihud from the previous trading day (adjusted by FF5)

The cumulative yield curve for the low Amihud portfolio exhibits a very clear downward trend, falling straight across the sample period. In contrast, the cumulative yield of the high Amihud portfolio continued to climb, with an accelerated rise around June 2015. Although the cumulative return of the high-Amihud portfolio stayed near the original level in 2016-2018, the gap between

it and the low-Amihud portfolio continued to widen. This is consistent with the results analyzed using monthly data. The persistently negative returns of the low Amihud portfolio throughout the sample period are strong evidence of its "mispricing."

In addition, this paper also divides the investment portfolio according to the level of trading volume on the previous trading day, analyzes the cumulative return of each portfolio with different levels of trading volume, and compares it with the situation of grouping by Amihud.

As shown in Figure 11, the returns of stock portfolios with different levels of trading volume also show large gaps. The cumulative return gap of the three portfolios with different transaction levels in the sample period is constantly widening. Among them, the cumulative yield of the stock portfolio with the smallest trading volume on the previous trading day has a strong upward trend. Except for the decline during the subprime mortgage crisis in 2008 and the stock market crash in 2015, it has repeatedly reached new highs in other periods, while the portfolio with the highest trading volume has a downward trend. Clearly, new lows continued throughout the sample period; portfolio returns with moderate transaction volumes were in between.

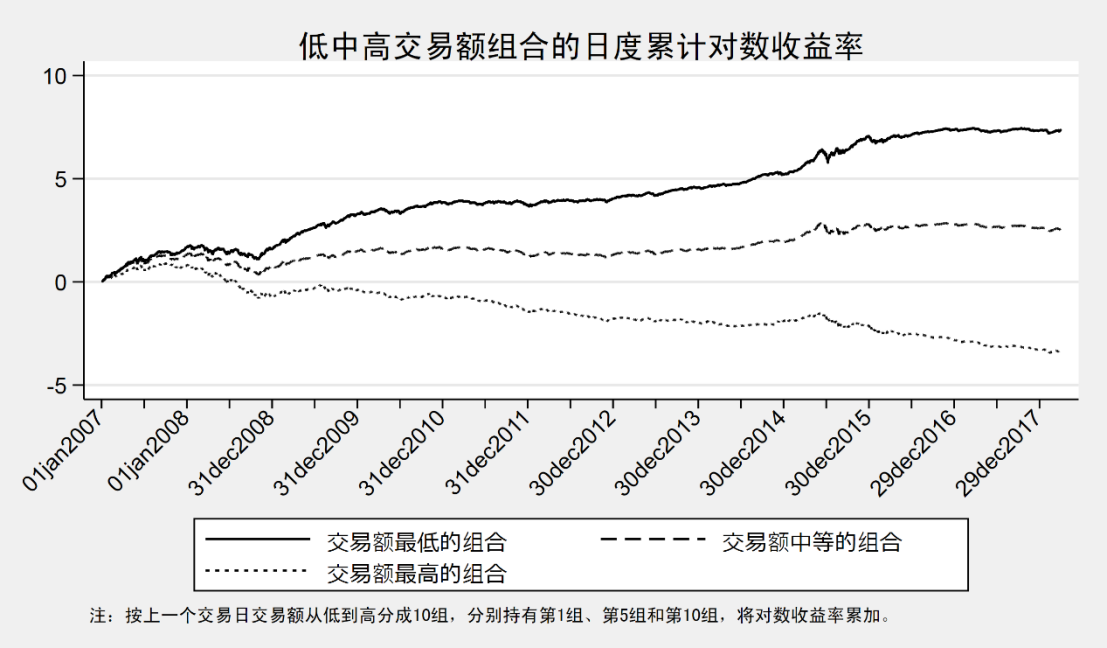

Figure 11: Cumulative returns for holding portfolios with low, medium, and high trading volumes from the previous trading day

After adjusting the returns of each stock using the FF5 factor model, as shown in Figure 12, the yield differentiation of the portfolio with low transaction value and the portfolio with high

transaction value is more obvious. The cumulative yield of high-volume portfolios continued to decline. The trend of the cumulative return of the high transaction value portfolio is very similar to the trend of the low Amihud portfolio, and the low transaction value portfolio corresponds to the high Amihud portfolio. This finding provides new evidence for the conclusion that "what is priced in the Amihud indicator is a component related to transaction value."

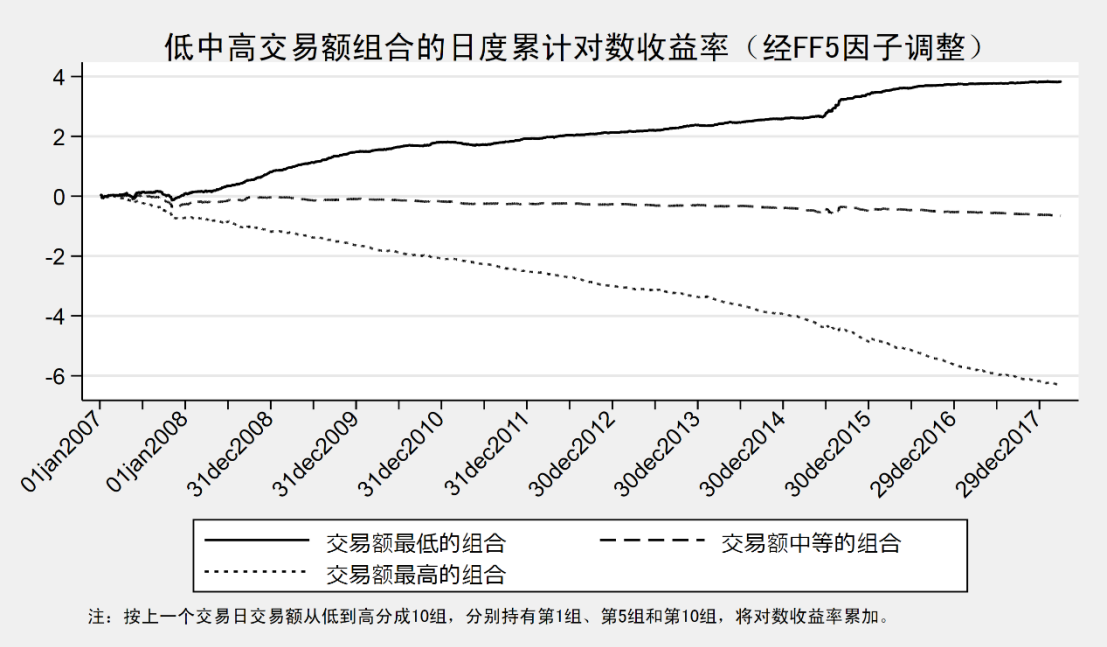

Figure 12: Cumulative returns for holding portfolios with low, medium, and high transaction value from the previous trading day (adjusted by FF5)

4.3.4 Regression analysis employing the three-factor and five-factor model

The above results have shown very intuitively the returns of the portfolios grouped from low to high Amihud levels on the previous trading day and the income differentiation between groups. On this basis, the paper also tests the returns of each portfolio to see if they are statistically and economically significant. Table 34 presents the returns, FF3 factor-adjusted returns, and FF5 factor-adjusted returns, and their significance levels for each portfolio. The yields above are minus the daily risk-free rate. In addition, in order to adjust for the possible heteroskedasticity of returns on each trading day, this paper reports the t-statistic calculated from the robust standard error of White's heteroscedasticity.

From the perspective of unadjusted returns, the portfolio returns increase with the increase of Amihud levels. The average daily return of the portfolio with the lowest Amihud is negative, while

the daily return of the portfolio with the highest Amihud reaches 0.2%. The difference is significant at the 1% level. Calculated based on 250 trading days in a year, the annualized yield gap reaches 50%.

This paper reports only the intercept term and its t-value in the three-factor or five-factor model. After adjustment by the FF3 factor, the average daily rate of return of the low Amihud portfolio is -0.1% (annualized -25%), which is significant at the 1% level, and an annual loss of 25% is a relatively large loss for investors. On the other hand, the daily yield of the high Amihud portfolio has decreased from the original 0.2% to 0.07%, but it is still significant at the 1% level. The yield gap between the high Amihud portfolio and the low Amihud portfolio is 0.175%, which is significant at the 1% level. In addition, it can be clearly seen from the results in Table 34 that as the Amihud level of the portfolio increases, the return rate adjusted by the FF3 factor also increases gradually.

The regression results of the five-factor model are very close to the three-factor model. After adjustment by the FF5 factor model, the return of the low Amihud portfolio is significantly negative at the 1% level, while the return of the high Amihud portfolio is significantly positive at the 1% level, and the difference between the two returns is 0.175%, the annualized rate reaches 43.75%. The above analysis results show that the returns of the low-Amihud portfolio and the high-Amihud portfolio and the difference between the two returns are both economically and statistically significant.

Table 34: Returns, FF3-adjusted, and FF5-adjusted returns for portfolios at different Amihud levels

	Bottom	2	3	4	5	6	7	8	9	Top	Top-Bottom
Returns	-0.000159	0.000239	0.000410	0.000574	0.000763*	0.000889**	0.00111**	0.00121***	0.00145***	0.00199***	0.00215***
	(0.000409)	(0.000425)	(0.000430)	(0.000432)	(0.000435)	(0.000435)	(0.000438)	(0.000436)	(0.000435)	(0.000428)	(0.000190)
FF3	-0.00103***	-0.000773***	-0.000671***	-0.000559***	-0.000416***	-0.000327**	-0.000134	-4.17e-05	0.000182	0.000724***	0.00175***
	(0.000142)	(0.000139)	(0.000140)	(0.000140)	(0.000138)	(0.000130)	(0.000135)	(0.000134)	(0.000141)	(0.000138)	(0.000158)
FF5	-0.00107***	-0.000811***	-0.000710***	-0.000599***	-0.000444***	-0.000359***	-0.000170	-6.74e-05	0.000143	0.000679***	0.00175***
	(0.000139)	(0.000135)	(0.000136)	(0.000136)	(0.000134)	(0.000124)	(0.000128)	(0.000128)	(0.000133)	(0.000132)	(0.000158)

Note: White (1980) robust standard errors of heteroskedasticity are in parentheses. ***, **, and * represent the significance levels of 1%, 5%, and 10%, respectively.

4.3.5 Event-study analyses about the high-Amihud-portfolio and low-Amihud-portfolio

Why is there such an obvious differentiation between the high-Amihud portfolio and the low-Amihud portfolio held in the previous trading day? In order to find the answer to this question, this paper adopts the event study method to analyze the changes in the rate of return and turnover before and after the abnormal returns of the high Amihud portfolio and the low Amihud portfolio of the previous trading day.

The specific steps of event research and analysis in this paper are as follows: First, divide the high Amihud portfolio and the low Amihud portfolio according to the Amihud indicator on the t-1th trading day, and then take the average of the percentage returns of all stocks in the portfolio on the t-th trading day to get the average return of the portfolio on the t-th trading day. Using the same method, this paper is from the t-50th trading day to the t-1th trading day (denoted as [t-50, t-1]) and the [t+1, t+50]th trading day. The percentage returns of the stocks in the portfolio are averaged as the average return of the portfolio on the corresponding trading day. Trading days that are not within the sample period of this paper are treated as missing values.

Through the above processing, this paper obtains the portfolio returns of the high Amihud portfolio and the low Amihud portfolio constructed on the t-1th trading day from the [t-50, t+50]th trading day, where t is all trading days in the research period of this paper. 's number. Then, this paper converts the portfolio returns into logarithmic returns, then averages all t, removes the sign of t, and obtains the high Amihud portfolio and the low Amihud portfolio formed on the -1st trading day from the [-50, 50] trading day yield. Finally, the yields are accumulated from the -50th trading day to obtain the cumulative yield curve. The turnover on the [-50, 50]th trading day is obtained in a similar way.

It is worth mentioning that this paper averages the percentage returns of the stocks in the portfolio on each trading day, which means that equal weights are invested in the stocks in the portfolio. Then, this paper converts the daily portfolio return time series into logarithmic returns, and then averages all dates, so that the average compound return is obtained, which means that each trading day will be the same as the one at the end of the previous trading day. All equity is fully reinvested.

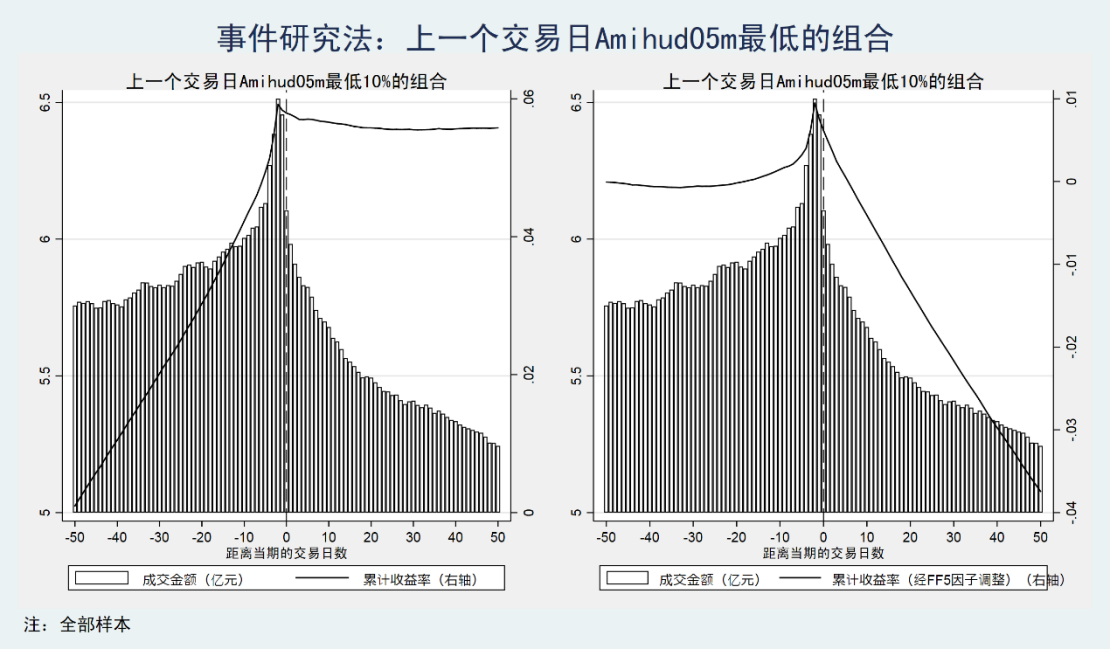

Figure 13: The cumulative yield and turnover trend of the low Amihud portfolio from the previous trading day

Figure 13 shows the results of an analysis of the combinations with the lowest Amihud indicator (5-minute frequency) in the previous trading day using the event study method. The left side shows the changes in the transaction amount and cumulative return before and after the low Amihud portfolio achieved negative returns on the 0th day. From the -50th day to the -1st day, the cumulative return rate and the transaction amount increased simultaneously. In particular, from the -10th to the -1st day, the rise of both accelerated, but from the 0th day, the cumulative yield reversed downwards, and resumed the rise from the 5th day, but the rate of increase was much lower than before. From the 0th day, the transaction amount started a downward trend, and the downward trend slowed down on the 20th day. This shows that with the rapid increase in turnover, the stock price has "overreacted," thereby overdrafting future returns, so the returns will remain low for a long time thereafter.

In addition, this paper uses the FF5 factor model to adjust the returns of individual stocks, subtracting the part expected by the FF5 factor model from the stock returns, which can eliminate the heterogeneity of individual stock returns that do not change over time (using the FF5 model intercept term to describe), and the impact of various risk factors on the rate of return on each trading day (measured by the product of the stock's risk factor coefficient and the current risk factor

realized value).

The FF5-adjusted returns also show an obvious pattern of "overreaction." From the -50th day to the -20th day, the trend of the cumulative yield is relatively flat, close to a horizontal line. However, from the -20th day to the -1st day, the cumulative yield accelerated, and the turnover increased sharply. However, from the 0th day, the cumulative yield began to reverse downward, and it plummeted in the next 50 trading days, and the turnover also continued to decrease. Through the above event research analysis, this paper clearly points out that the reason why the low Amihud portfolio achieves negative excess returns on day 0 is the "overreaction" of investors.

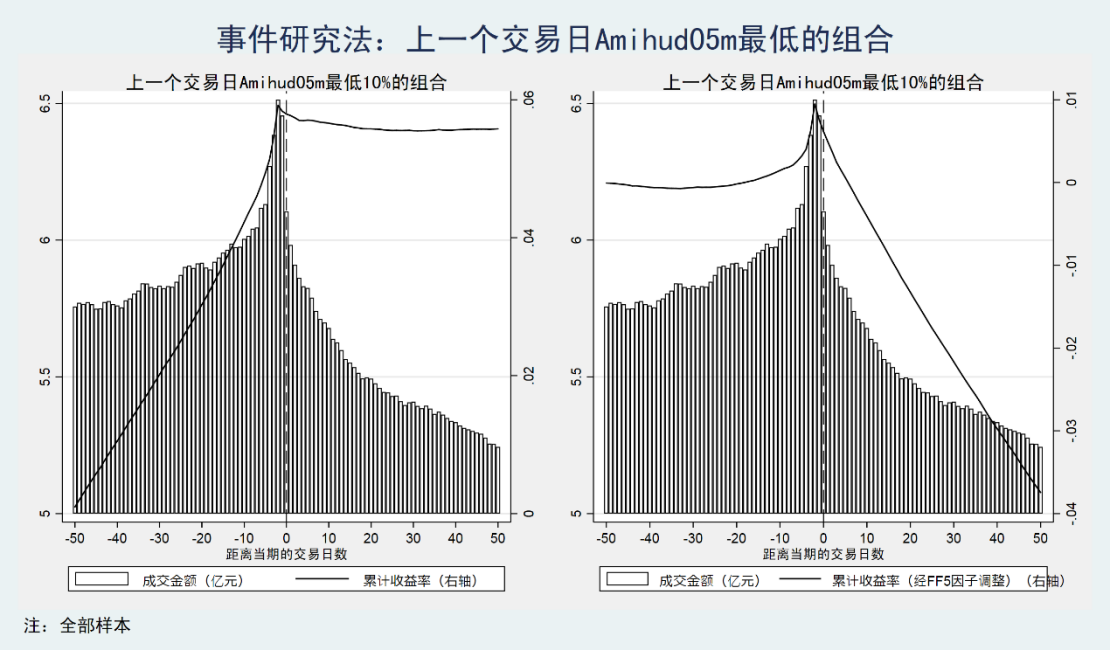

Figure 14: Cumulative yield and turnover trend of high Amihud portfolios in the previous trading day

In addition, this paper also analyzes the transaction amount and cumulative yield of the portfolio with the highest Amihud on the previous trading day before and after the 0th day, as well as the cumulative yield adjusted by the FF5 factor. The left side of Figure 14 shows the cumulative rate of return and transaction volume. From the -50th day to the -10th day, the cumulative rate of return rose slowly, rising by 2% within 40 trading days. From the -10th day, the cumulative rate of return Started to fall, accompanied by a rapid decrease in turnover. After that, from the 0th day, the cumulative yield began to reverse upward, and showed a strong upward trend. In the following 50 trading days, the cumulative yield increased by more than 6%, and the turnover also quickly

recovered, and then increased to a higher level than before. s level.

The cumulative yield adjusted by FF5 continued to fall before day 0, and the rate of decline accelerated from day -10 to day -1. After that, starting from day 0, the cumulative return began to reverse upward, and then recorded positive returns for 5 consecutive trading days. Since then, the cumulative yield has flattened, and has fallen slightly after the 30th day. This is not the case with the monthly data, where the cumulative yield has continued to rise for more than 30 months after month 0.

It can be seen from the above analysis that investors who want to reap the excess returns of the high Amihud portfolio on day 0 need to take greater risks, because the stocks in the high Amihud portfolio usually experience a rapid decline in stock prices before the 0th day. The continued decline in trading volumes is a sign that investors are reluctant to touch these stocks. Therefore, holding stocks with high Amihud portfolios will receive excess returns as compensation, which confirms the explanation of "illiquidity compensation."

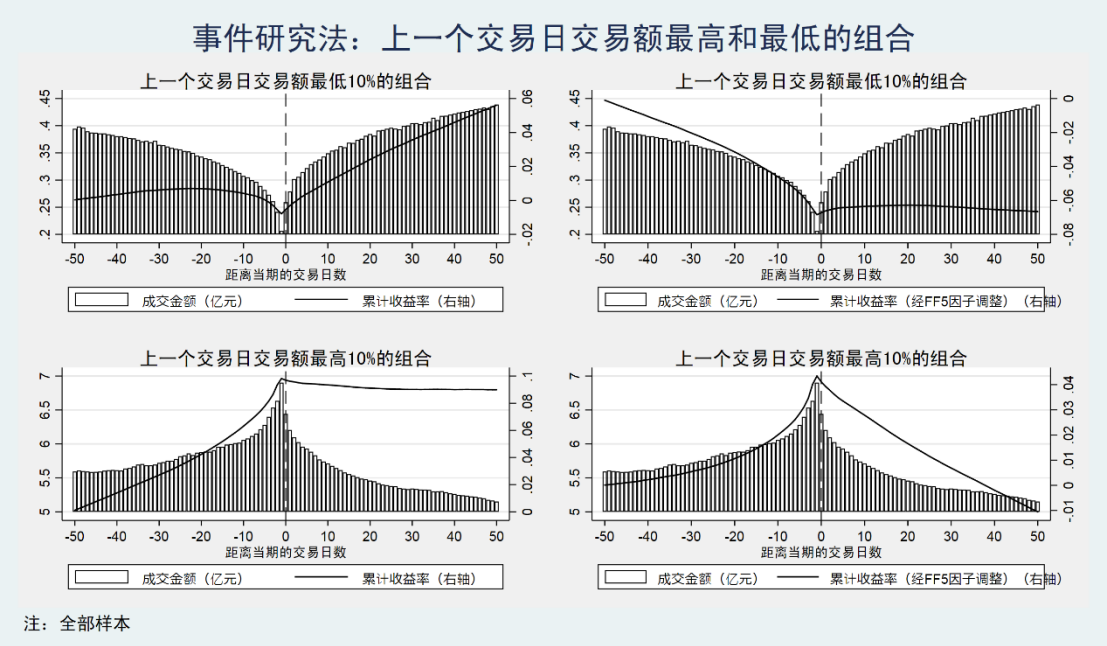

Figure 15: Cumulative yield and turnover trend of low- and high-volume portfolios from the previous trading day

In order to contrast the situation with the low and high Amihud portfolios, an event study analysis is also performed on the portfolios with the highest and lowest transaction value. As shown in Figure 15, the yield trend of the portfolio with high transaction value is very similar to

that of the portfolio with low Amihud, showing a predominant phenomenon of "overreaction"; while the portfolio with low transaction volume is similar to the portfolio with high Amihud, and their cumulative returns both resume after a rapid decline. Therefore, the information captured by the transaction volume and the Amihud indicator is relatively similar, which supports the proposition "Amihud indicator is priced as a component related to transaction volume."

In general, the stable high returns of high Amihud portfolios and the persistent negative returns of low Amihud portfolios together constitute the "Amihud premium" in the A-share market. Among them, the high yield of the high Amihud portfolio comes from the "illiquidity compensation" after the rapid decline in the stock price and turnover, while the negative return of the low Amihud portfolio is caused by the "mispricing" accompanying the rapid rise in the stock price and turnover.

5. Summary

In order to study whether the "Amihud premium" (the difference between the returns of the high-Amihud portfolio and the low-Amihud portfolio) is caused by "illiquidity compensation" or "mispricing," this paper uses the standard methods of the financial literature to analyze the data of the A-share market. A very detailed empirical analysis was conducted. This paper confirms that the "Amihud premium" in the A-share market is robust and economically and statistically significant. In addition, this paper finds that high Amihud portfolios obtain high returns as compensation due to poor liquidity, while low Amihud portfolios continue to gain negative returns due to investors' "overreaction." The conclusions of this paper have passed a series of robustness tests.

The conclusions of this paper have rich and profound policy implications. Good liquidity is often considered a favorable attribute for investors, as it means low transaction costs, short closing times, or large transaction amounts. However, the results of this paper show that holding the most liquid stocks in the A-share market will continue to bring losses. Therefore, good liquidity is also a signal of a higher degree of speculation, which deserves the attention of investors and policymakers. On the other hand, although stocks with poor liquidity have many unfavorable factors such as high transaction costs and small company size, they will obtain higher returns as compensation. This finding has great implications for investors to re-understand the meaning of stock liquidity and realize rational investment.

Harrison and Kreps (1978) [47] point out that two key preconditions for "mispricing" are short selling constraints and investors' heterogeneous beliefs. At present, there are serious short selling constraints in the A-share market, and there are huge differences in belief among investors, which provides excellent soil for the occurrence of "mispricing." Therefore, while the regulators gradually release the liquidity of the stock market, they also need to pay close attention to and prevent the intensification of market speculation. Because the "mispricing" of stocks will not only cause losses to overly optimistic investors, but also cause distortions in the allocation of financial resources, thereby impairing the function of the stock market to support the real economy and, in the long run, the economic competitiveness of the entire country. Therefore, policy makers should start from the source of "mispricing" to further improve the short-selling system in the A-share market and develop the stock derivatives market, which is crucial to the improvement of the financial efficiency of the A-share market and the enhancement of the overall strength of the national economy.

REFERENCES

[1] Lou X, Shu T. Price impact or trading volume: Why is the Amihud (2002) measure priced?[J]. The Review of Financial Studies, 2017, 30(12): 4481-4520.

[2] Amihud Y, Noh J. Illiquidity and stock returns–II: Cross-section and time-series effects[J]. Available at SSRN 3139180, 2018.

[3] Amihud Y. Illiquidity and stock returns: Cross-section and time-series effects[J]. Journal of Financial Markets, 2002, 5(1): 31-56.

[4] Amihud Y, Hameed A, Kang W, et al. The illiquidity premium: International evidence[J]. Journal of Financial Economics, 2015, 117(2): 350-368.

[5] Harris L, Amato A. Illiquidity and stock returns: Cross-section and time-series effects: a replication[J]. Available at SSRN 2901327, 2018.

[6] Lou X, Shu T. Summary and discussions: "Price impact or trading volume: Why is the Amihud (2002) measure priced?"[J]. Available at http://people.terry.uga.edu/taoshu/RFS2017-summary, 2018.

[7] Baker M, Stein J C. Market liquidity as a sentiment indicator[J]. Journal of Financial Markets, 2004, 7(3): 271-299.

[8] Scheinkman J A, Xiong W. Overconfidence and speculative bubbles[J]. Journal of Political Economy, 2003, 111(6): 1183-1220.

[9] 张峥, 刘力. 换手率与股票收益: 流动性溢价还是投机性泡沫?[J]. 经济学 (季刊), 2006 (2).

[10] Barinov A. Turnover: Liquidity or uncertainty?[J]. Management Science, 2014, 60(10): 2478-2495.

[11] Goyenko R Y, Holden C W, Trzcinka C A. Do liquidity measures measure liquidity?[J]. Journal of Financial Economics, 2009, 92(2): 153-181.

[12] 张峥, 李怡宗, 张玉龙, 等. 中国股市流动性间接指标的检验——基于买卖价差的实证分析[J]. 经济学 (季刊), 2014 (1): 233-262.

[13] Fama E F, French K R. A five-factor asset pricing model[J]. Journal of Financial Economics, 2015, 116(1): 1-22.

[14] Fama E F, French K R. Dissecting anomalies with a five-factor model[J]. The Review of Financial Studies, 2016, 29(1): 69-103.

[15] 史永东, 袁绍锋. 市场流动性与资产定价理论评述[J]. 经济学动态, 2011 (5): 129-134.

[16] 张玉龙, 李怡宗. 基于随机折现因子方法的流动性定价机制研究[J]. 管理世界, 2013 (10): 35-48.

[17] 万孝园, 杨朝军. 流动性风险定价研究综述[J]. 投资研究, 2017, 36(2): 101-110.

[18] 王妍婕, 罗钢青. 流动性, 流动性冲击及资产价格波动: 一个综述[J]. 投资研究, 2017, 36(10): 129-142.

[19] Amihud Y. Illiquidity and stock returns: A revisit[J]. Critical Finance Review, Forthcoming, 2018.

[20] 吴文锋, 芮萌, 陈工孟. 中国股票收益的非流动性补偿[J]. 世界经济, 2003 (7).

[21] 梁丽珍, 孔东民. 中国股市的流动性指标定价研究[J]. 管理科学, 2008 (3): 10.

[22] 苏冬蔚, 麦元勋. 流动性与资产定价: 基于我国股市资产换手率与预期收益的实证研究[J]. 经济研究, 2004 (2): 95-105.

[23] 黄峰, 杨朝军. 流动性风险与股票定价: 来自我国股市的经验证据[J]. 管理世界, 2007 (5): 8.

[24] Baker M, Wurgler J. Investor sentiment and the cross-section of stock returns[J]. The Journal of Finance, 2006, 61(4): 1645-1680.

[25] Pástor Ľ, Stambaugh R F. Liquidity risk and expected stock returns[J]. Journal of Political Economy, 2003, 111(3): 642-685.

[26] Zhang X F. Information uncertainty and stock returns[J]. The Journal of Finance, 2006, 61(1): 105-137.

[27] McLean R D, Pontiff J. Does academic research destroy stock return predictability?[J]. The Journal of Finance, 2016, 71(1): 5-32.

[28] Eleswarapu V R, Reinganum M R. The seasonal behavior of the liquidity premium in asset pricing[J]. Journal of Financial Economics, 1993, 34(3): 373-386.

[29] Hasbrouck J. Trading costs and returns for US equities: Estimating effective costs from daily data[J]. The Journal of Finance, 2009, 64(3): 1445-1477.

[30] Amihud Y, Mendelson H. Asset pricing and the bid-ask spread[J]. Journal of Financial Economics, 1986, 17(2): 223-249.

[31] Brennan M, Huh S W, Subrahmanyam A. An analysis of the Amihud illiquidity premium[J]. The Review of Asset Pricing Studies, 2013, 3(1): 133-176.

[32] Drienko J, Smith T, Von Reibnitz A. A review of the return-illiquidity relationship[J]. Critical Finance Review, 2018, 7: 1-45.

[33] Ben-Rephael A, Kadan O, Wohl A. The diminishing liquidity premium[J]. Journal of Financial and Quantitative Analysis, 2015, 50(1-2): 197-229.

[34] Brennan M J, Chordia T, Subrahmanyam A. Alternative factor specifications, security characteristics, and the cross-section of expected stock returns[J]. Journal of Financial Economics, 1998, 49(3): 345-373.

[35] Datar V T, Naik N Y, Radcliffe R. Liquidity and stock returns: An alternative test[J]. Journal of Financial Markets, 1998, 1(2): 203-219.

[36] Chordia T, Roll R, Subrahmanyam A. Market liquidity and trading activity[J]. The Journal of Finance, 2001, 56(2): 501-530.

[37] Harris M, Raviv A. Differences of opinion make a horse race[J]. The Review of Financial Studies, 1993, 6(3): 473-506.

[38] Blume L, Easley D, O'hara M. Market statistics and technical analysis: The role of volume[J]. The Journal of Finance, 1994, 49(1): 153-181.

[39] Kandel E, Pearson N D. Differential interpretation of public signals and trade in speculative markets[J]. Journal of Political Economy, 1995, 103(4): 831-872.

[40] Lee C M C, Swaminathan B. Price momentum and trading volume[J]. the Journal of Finance, 2000, 55(5): 2017-2069.

[41] Gervais S, Odean T. Learning to be overconfident[J]. The Review of Financial Studies, 2001, 14(1): 1-27.

[42] Jiang G, Lee C M C, Zhang Y. Information uncertainty and expected returns[J]. Review of Accounting Studies, 2005, 10(2-3): 185-221.

[43] Allen F, Gorton G. Churning bubbles[J]. The Review of Economic Studies, 1993, 60(4): 813-836.

[44] Allen F, Gale D. Bubbles and crises[J]. The Economic Journal, 2000, 110(460): 236-255.

[45] Barberis N, Huang M. Stocks as lotteries: The implications of probability weighting for security prices[J]. American Economic Review, 2008, 98(5): 2066-2100.

[46] Miller E M. Risk, uncertainty, and divergence of opinion[J]. The Journal of Finance, 1977, 32(4): 1151-1168.

[47] Harrison J M, Kreps D M. Speculative investor behavior in a stock market with heterogeneous expectations[J]. The Quarterly Journal of Economics, 1978, 92(2): 323-336.

[48] Hong H, Scheinkman J, Xiong W. Asset float and speculative bubbles[J]. The Journal of Finance, 2006, 61(3): 1073-1117.

[49] Hong H, Stein J C. A unified theory of underreaction, momentum trading, and overreaction in asset markets[J]. The Journal of Finance, 1999, 54(6): 2143-2184.

[50] Hong H, Stein J C. Differences of opinion, short-sales constraints, and market crashes[J]. The Review of Financial Studies, 2003, 16(2): 487-525.

[51] Hong H, Stein J C. Disagreement and the stock market[J]. Journal of Economic Perspectives, 2007, 21(2): 109-128.

[52] Stambaugh R F, Yu J, Yuan Y. The short of it: Investor sentiment and anomalies[J]. Journal of Financial Economics, 2012, 104(2): 288-302.

[53] Xiong W, Yu J. The Chinese warrants bubble[J]. American Economic Review, 2011, 101(6): 2723-53.

[54] 韩乾, 洪永淼. 国家产业政策, 资产价格与投资者行为[J]. 经济研究, 2014, 12: 143-158.

[55] 李心丹, 俞红海, 陆蓉, 等. 中国股票市场 “高送转” 现象研究[J]. 管理世界, 2014, 11: 133-145.

[56] Fama E F, French K R. The cross-section of expected stock returns[J]. the Journal of Finance, 1992, 47(2): 427-465.

[57] Fama E F, MacBeth J D. Risk, return, and equilibrium: Empirical tests[J]. Journal of Political Economy, 1973, 81(3): 607-636.

[58] Newey W K, West K D. A Simple, Positive Semi-Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix[J]. Econometrica: Journal of the Econometric Society, 1987: 703-708.

[59] Fang V W, Tian X, Tice S. Does stock liquidity enhance or impede firm innovation?[J]. The Journal of Finance, 2014, 69(5): 2085-2125.

[60] Avramov D, Kaplanski G, Subrahmanyam A. Stock return predictability: New evidence from moving averages of prices and firm fundamentals[J]. Available at SSRN 3111334, 2018.

[61] 易志高, 茅宁. 中国股市投资者情绪测量研究: CICSI 的构建[J]. 金融研究, 2009, 11: 174-184.

[62] Acharya V V, Pedersen L H. Asset pricing with liquidity risk[J]. Journal of Financial Economics, 2005, 77(2): 375-410.

[63] Halbert W. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity[J]. Econometrica, 1980.

[64] Carhart M M. On persistence in mutual fund performance[J]. The Journal of Finance, 1997, 52(1): 57-82.

[65] Chen T, Gao Z, He J, et al. Daily price limits and destructive market behavior[J]. Journal of Econometrics, 2019, 208(1): 249-264.

[66] Foley S, Putniņš T J. Should we be afraid of the dark? Dark trading and market quality[J]. Journal of Financial Economics, 2016, 122(3): 456-481.

APPENDIES

I. The definitions and computations of high-frequency indicators

1. Relative bid-ask spread

The relative price spread Rpd is a commonly used indicator in the literature to measure stock liquidity, which reflects the transaction cost. Assuming that the investor's transaction amount is small enough to not affect the market price, ignoring other transaction costs, the meaning of Rpd is the loss caused by the investor selling the stock immediately after buying it. Generally speaking, the larger the relative quotation spread, the higher the transaction cost and the less liquid the stock. It is obtained by dividing the difference between the selling price and the buying price in the market order book by the median value of the selling price and the buying price. The specific calculation formula is as follows:

$$Rpd = \frac{S_1 - B_1}{(S_1 + B_1)/2} \times 100\%,$$

Among them, S_1 represents the selling price of one; B_1 represents the buying price of one. Calculated according to the above formula, the relative price difference of a time point will be obtained. Each stock has several time points on each trading day (the frequency of time points for stocks listed on the Shanghai Stock Exchange is every 3 seconds, and Shenzhen Securities Trading Co., Ltd. The frequency of each transaction is 5 seconds), referring to the calculation method of Folin and Putnins (2016) [66], this paper selects the time periods of 9:45-11:30 and 13:00-14:45 on each trading day to calculate each time point the average of the relative quotation spreads to obtain the average relative quotation spreads of each stock on each trading day, and then average by month. In addition, when the stock goes up or down, if the original calculation formula is directly used, misleading results may be obtained. GTA CSMAR high-frequency database records the missing S1 as 0 during the daily limit, so the relative price difference Rpd calculated according to the formula is -200. Rpd is normally between 0 and 1%. Therefore, when calculating the indicators, this article excludes the time points of the daily limit.

2. Best quote order depth

Best quote order depth refers to the average amount of buy-one and sell-one in the market order book, representing the unfilled part of the order in the buy-one and sell-one tiers in the market. Generally speaking, the greater the quotation depth of the first tier, the more immediate The larger the transaction amount of buying at one price (or selling at one price), that is, the transaction will be executed immediately without affecting the market price, and the better the market liquidity. The specific calculation formula is as follows:

$$Depth1 = \frac{S_1 * SV_1 + B_1 * BV_1}{2},$$

Among them, S_1 represents the selling price one, SV_1 represents the selling volume one; B_1 represents the buying price one, and BV_1 represents the buying volume one. Similar to the calculation method of the relative price difference Rpd, this article firstly uses the time points of 9:45-11:30 and 13:00-14:45 in each trading day of each stock (excluding the period when the stock price has a limit of up and down) Take the average value, and then take the average value by month, and finally get the stock-month Best quote order depth indicator.

3. Best five quote order depth

The construction method of the indicator for the Best five quote order depth is similar to that of the one-level quotation depth. The five-level quotation depth refers to the average amount of buy one to buy five and sell one to five in the market order book, representing the unfilled part of the order in the market for buy one to buy five and sell one to five It is said that the greater the depth of the five-level quotation, the greater the transaction amount that can be immediately bought at the bid price of 1 to the bid price of 5 (or sold at the ask price of 1 to the ask price of 5), that is, the transaction will be executed immediately without affecting the market price. Great influence, the better the market liquidity. Calculated as follows:

$$Depth2 = \frac{\sum_{i=1}^{5} \mathrm{S}_i * \mathrm{SV}_i + \mathrm{B}_i * \mathrm{BV}_i}{2},$$

Among them, S_i represents the entrusted selling price of the i tier, SV_i represents the entrusted selling volume of the i tier entrusted selling price; B_i represents the i tier entrusted buying price, and BV_i represents the entrusted buying quantity of the i tier entrusted buying price. Similarly, this paper selects the non-limit-up/down periods of 9:45-11:30 and 13:00-14:45 on each trading day to calculate the average value of the Best five quote order depth.

4. High-frequency versions of Amihud measure

In addition to the daily data, this paper also uses data at 3 seconds, 1 minute, 5 minutes, 10 minutes, 15 minutes, 30 minutes, and 60 minutes of frequency to calculate the Amihud metrics. Calculated as follows:

$$Amihud_{i,s,y} = \frac{1}{T_{i,s,y}} \sum_{t=1}^{T_{i,s,y}} \frac{|R_{i,s,y,t}|}{Vol_{i,s,y,t}},$$

Where $Amihud_{i,s,y}$ refers to the Amihud index of stock i on the y-th trading day of the s-th month, and $T_{i,s,y}$ represents the stock i traded on the yth trading day of the sth month The number of intra-day time periods, $|R_{i,s,y,t}|$ is the absolute value of the stock return of stock i in the t-th time period on the y-th trading day of the s-th month, $Vol_{i,s,y,t}$ is the transaction amount during the time period. In this paper, the average value of each time point of 9:45-11:30 and 13:00-14:45 in each trading day of each stock is firstly taken, and then averaged by month, and finally the Amihud indicator of each frequency of stock-month is obtained. This paper selects different frequencies to calculate the high-frequency Amihud indicator. For stocks listed on the Shanghai Stock Exchange, the fastest frequency is 3 seconds, and for stocks listed on the Shenzhen Stock Exchange, the fastest frequency is 5 seconds. Calculated at the fastest frequency The obtained index is named Amihud_hf; in addition, this paper also selects other frequencies to calculate the Amihud index, including 1 minute, 5 minutes, 10 minutes, 15 minutes, 30 minutes and 60 minutes, and the calculated indexes are recorded as Amihud01m, Amihud05m, Amihud10m, Amihud15m, Amihud30m and Amihud60m, respectively.

5. Realized Volatility

The paper also calculates the realized volatility RV, which captures information about intraday price movements. The specific calculation formula of RV is:

$$Rv_{i,s,y} = \sqrt{\sum_{t=1}^{T_{i,s,y}} {R_{i,s,y,t}}^2},$$

where $Rv_{i,s,y}$ is the realized volatility of stock i on the yth trading day of the sth month, $T_{i,s,y}$ represents the number of time periods in the trading day, $R_{i,s,y,t}$ is the stock return of stock i in the t-th time period on the y-th trading day of the s-th month. Similarly, this paper first calculates the daily realized volatility according to the time points of 9:45-11:30 and 13:00-14:45 in each trading day of each stock, and then takes the average by month. Similar to the high-frequency version of the Amihud indicator, the frequency at which this paper calculates realized volatility varies from 3 seconds to 60 minutes.

II. Event-study method (using partial sample)

1. Event-study analyses using monthly data

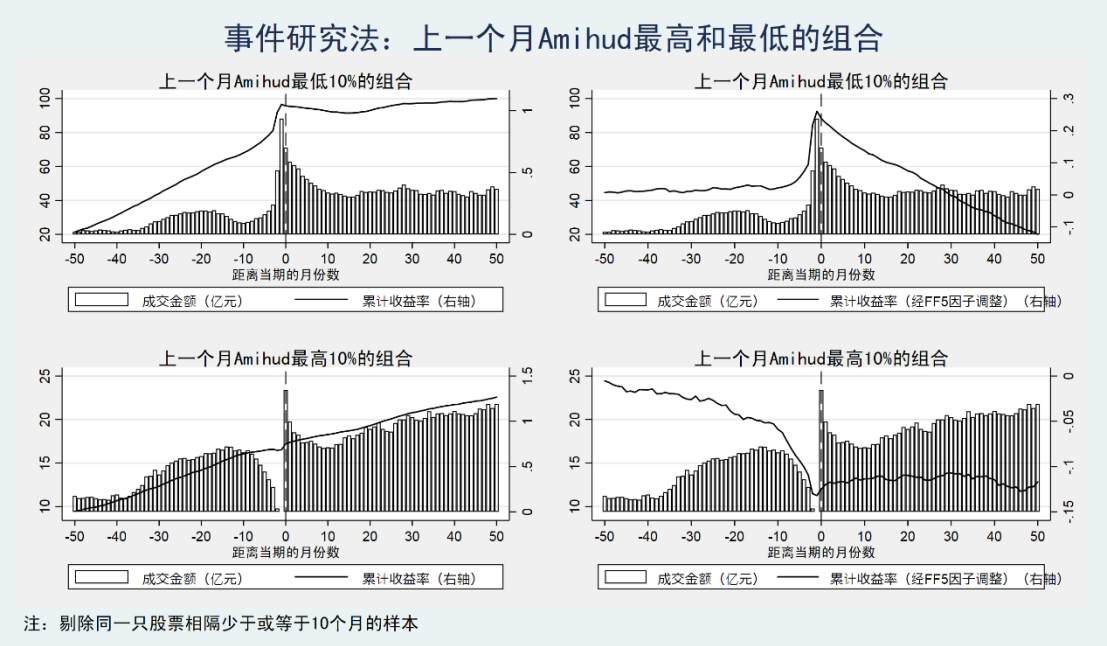

Figure 16: Cumulative yield and turnover trend of low and high Amihud portfolios last month

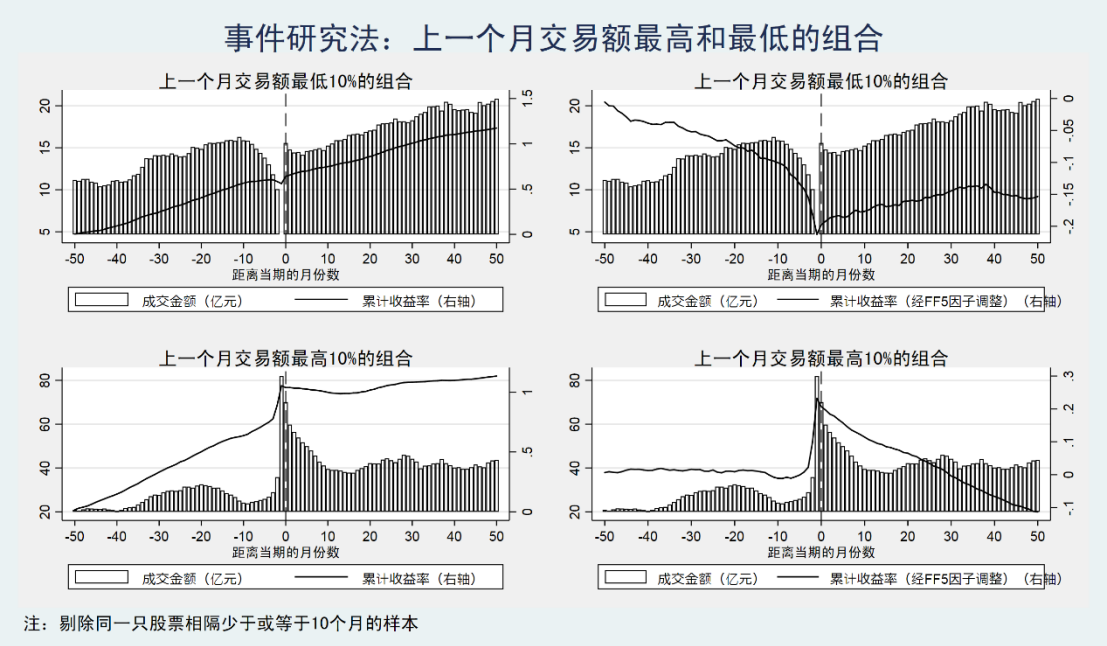

Figure 17: Cumulative return and turnover trend of the portfolio with high and low transaction value in the last month

2. Event-study analyses using daily data

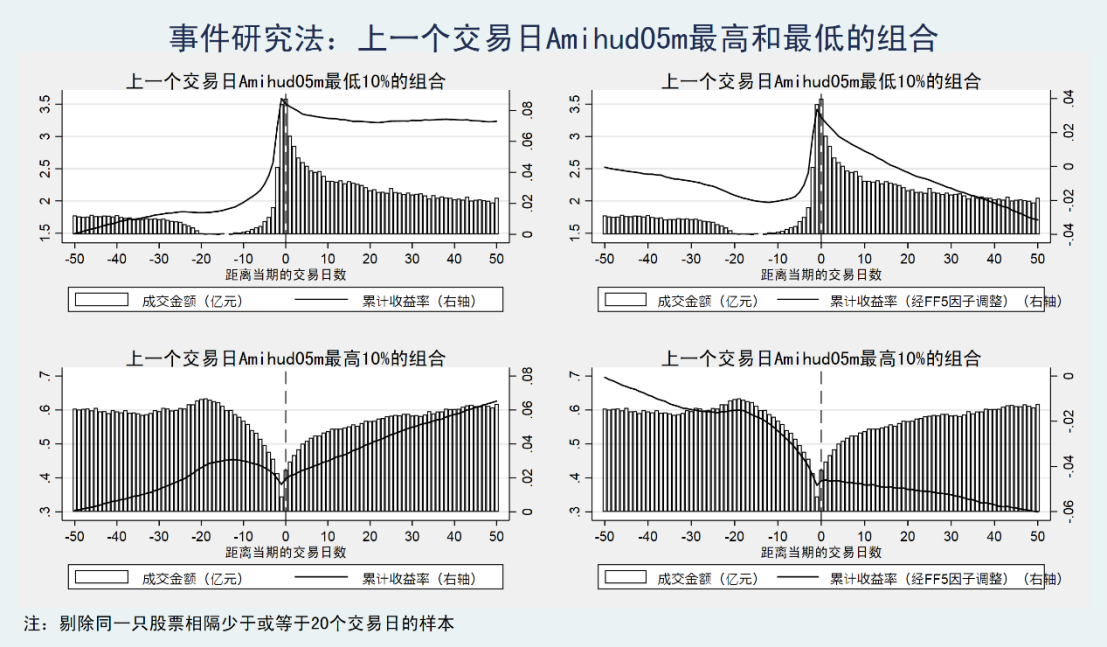

Figure 18: Cumulative yield and turnover trend of high and low Amihud portfolios in the previous trading day

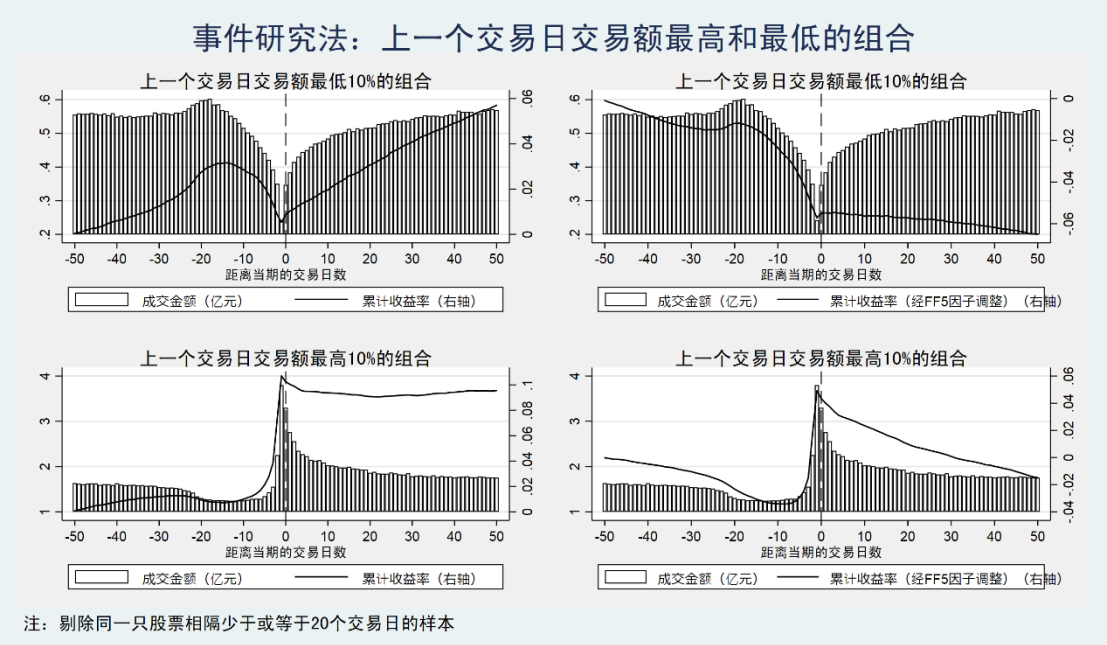

Figure 19: Cumulative return and turnover trend of the combination of high and low trading volume in the previous trading day